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AN EXAMINATION OF EARNINGS IN CERTAIN STANDARD MACHINE-TOOL OCCUPATIONS IN PHILADELPHIA

By

H. LARUE FRAIN

A THESIS

IN ECONOMICS

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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PREFACE

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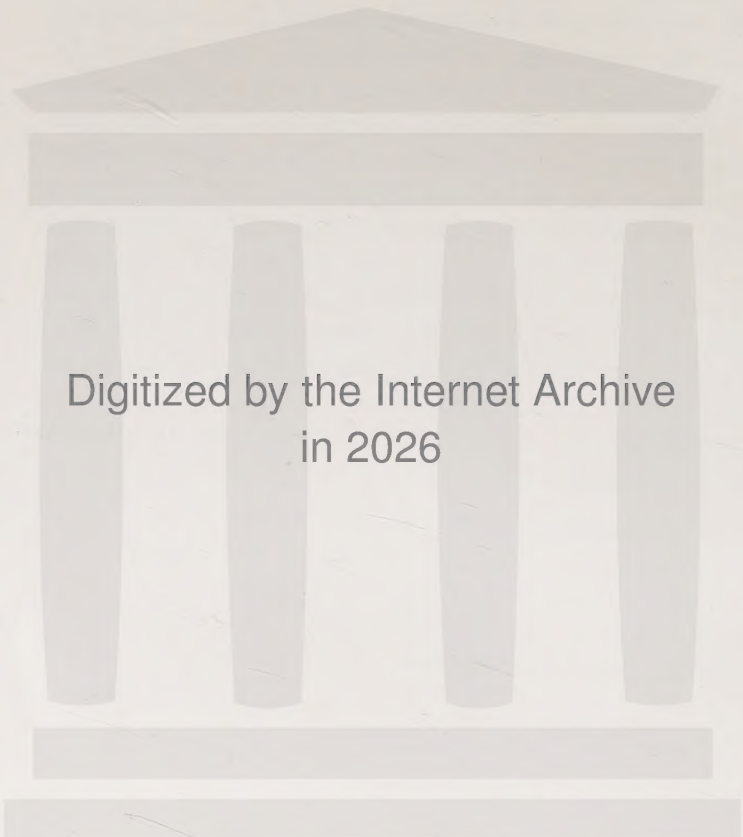
H. LaRue Frain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INTRODUCTION

According to current economic theory, the wages in a locality, for workers in a given group, will be proportionate to the ability of the workers. This conclusion is based on the assumption that economic forces are in equilibrium and that perfect competition prevails. At any given time, however, it is recognized that these assumptions are not fully realized, and consequently, factors other than ability not only may, but probably do, affect wages.[1] As a result, the economists make a distinction between normal and market wages.

In many discussions, however, the term "market wages" implies that the prevailing wages at a given time are actually uniform, or at least subject to very small variations and there is reason to suspect that this view, which is frequently encountered among employers, also dominates the thinking of many economists.

It is the main purpose of this study to examine rather minutely the earnings of a group of workers in certain selected occupations, especially with a view to determining what relation there is, if any, between the earnings of these workers and certain variables seldom considered in wage comparisons. Whether or not such differences as may appear in the earnings are greater than those which can be attributed to differences in the ability of the workers is a question which cannot be answered directly in a satisfactory manner. But in a study such as this a roundabout approach may be made by inquiring whether or not certain factors other than ability appear to influence these earnings. This study does not pretend to consider all the relevant variables, nor does it assume that those chosen are ultimate or final. Rather they reflect *some* of the influences affecting wages which can be

[1] In this study the term "wages" is used as a collective term to designate monetary payments without regard to the period of time involved.

expressed in a manner sufficiently precise to warrant quantitative analysis and they are *among* those variables concerning which diverse assumptions are frequently made.

In confining the analysis to the relation of certain variables to money wages, there is no implication that monetary payments alone influence the mobility of workers or the desirability of a job. The principal reason for giving attention to money wages is that prices lend themselves most readily and satisfactorily to objective and quantitative analysis. It might be argued further that, in general, monetary payments are more important than other considerations, especially to workers whose money wages are in the neighborhood of those to be treated presently.

For this detailed analysis a few occupations have been selected from a much larger number for which data were available. In making the choice of occupations, it seemed wise to select those which were conspicuous in modern industry. This meant that they would be technologically important, widely distributed and generally recognizable wherever they are found. In the second place, it seemed wise to select occupations in which there were considerable numbers of workers, particularly men. These qualifications were met most satisfactorily by the occupations based upon the operation of, and taking their respective names from, the following standard machine tools:

Boring drill
Drill press
Engine lathe
Milling machine
Planer
Screw machine
Turret lathe

While these seven standard machine-tool occupations are thought to be peculiarly well-suited for the subsequent analysis, no assumption is made that a given machine is identical wherever it is found. It is assumed that it would be difficult to find occupations more closely defined and more generally understood than those selected and if the custom-

ary three- or four-fold grouping of workers were used, substantially all the operators of these machine tools would be classified as skilled employees.

Three distinct and yet related sets of data pertaining to wages in the metal industry of Philadelphia have been utilized in this study. The first is a survey of hourly and weekly earnings covering a period of a week in April, 1927; the second is a survey of hourly, weekly and yearly earnings for 1925 and 1926; the third is a series of semi-annual surveys of hourly earnings.

Of most importance to the subsequent analysis is the April 1927 survey.[2] On the basis of this the initial selection of occupations for this study was largely made. The entire survey covered 25,459 employees, exclusive of clerical and executive forces, in over 100 occupations in 83 metal-manufacturing plants in the Philadelphia area. In the seven occupations selected for intensive analysis, there were 1456 men distributed among 43 plants. Not only did this survey furnish a basis for the selection of occupations for detailed study, but much of the data for the study was also derived from it. Most of the analysis in Chapters I, II and III, and part of the analysis of Chapter IV, rests on these data.

Partly to supplement the information obtained by the April 1927 survey and partly to obtain new information, a second survey was conducted.[3] Actual earnings and actual working time, week by week, for the years 1925 and 1926[4] were obtained for all the men in five of the seven occupa-

[2] Miss Anne Bezanson, assisted by Miss Miriam Hussey, both of the Industrial Research Department of the University of Pennsylvania, directed this survey. Mr. Earl Sparks, secretary of the Metal Manufacturers' Association of Philadelphia, lent assistance in various ways. The present writer participated in this survey only to the extent required for the analysis he was planning. Plants reported not only earnings but also method of payment and both normal and actual working time for each employee.

[3] This survey was directed by the writer, as a member of the Industrial Research Department of the University of Pennsylvania, with the co-operation of Miss Bezanson, Miss Hussey and Mr. Sparks.

[4] It was during the latter part of 1927 that the collection of data began and the years 1925 and 1926 were the most recent ones for which records were readily available.

tions[5] previously named. Thus information became available regarding hourly, weekly and yearly earnings and working time over a long period. Certain other information, including length of service and working time,[6] was obtained for each employee. A total of 652 men was reported in 1925 and 1086 in 1926 by eleven firms in the former and two additional firms in the latter year. Hereafter this survey will be referred to as the "1925-1926 survey" and these data constitute the basis for part of Chapter IV and all of Chapter V.

A third source of information is the semi-annual reports of the Metal Manufacturers' Association of Philadelphia.[7] Periodic surveys of hourly earnings had been made with the idea of supplying employers with information about wages in the market for certain occupations. These reports, the accuracy of which was confirmed by the April 1927 survey, furnish historical information regarding hourly earnings in the occupations with which this study deals and are used in one part of Chapter I.

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[5] Planer and boring mill operating were not deemed sufficiently important for the purposes of the survey to be included.

[6] Also training, age, grade and method of payment. An analysis of these factors is found in "Factors Influencing the Collection of Wage Data," written by the present writer and published by the Industrial Research Department of the University of Pennsylvania.

[7] These reports were compiled under the direction of Mr. Earl Sparks, secretary of the Metal Manufacturers' Association of Philadelphia.

CHAPTER I

A PRELIMINARY EXAMINATION OF EARNINGS IN SELECTED OCCUPATIONS

In view of references, implied and expressed, to "the market wage" for an occupation, which are met in the writings of some economists and in discussion of wages by the employers, as though there were a uniform price for workers in an occupation in a market, it may be well to consider the actual wages in the seven standard machine-tool occupations selected for analysis. Tables 1 and 2 give the distribution of average hourly and actual weekly earnings respectively for each occupation and for the combined occupations as of April, 1927. The most conspicuous feature revealed by these tables is that earnings, both hourly and weekly, are not uniform in any occupation. It is quite evident that any reference to "the market wage" cannot refer accurately to a single price as being the uniform price for all the workers in an occupation.

As a matter of fact, there is, in the combined occupations, a difference of $1.18 between the lowest and the highest average hourly earnings, the lowest figure being 27 cents and the highest $1.45. On the basis of actual weekly earnings, the spread between the lowest figure of $11.50 and the highest of $76.50 is $65.00.* Expressed in terms of relative standard deviation, the dispersion of weekly earnings is more marked than that of hourly earnings, the former being 27.3 per cent and the latter 21.2 per cent.

If only those men are considered who worked the normal time of their plants [1]—this means 760 of the entire number

* A few extreme cases, including one of hourly earnings at $1.77, two of weekly earnings under $10.00 and one at $95.50, have been disregarded.

[1] "Men who worked the normal time of their plants" or "normal time cases" are expressions which refer to those men who actually worked a

TABLE 1

FREQUENCY DISTRIBUTION OF AVERAGE HOURLY EARNINGS FOR SPECIFIED MACHINE-TOOL OCCUPATIONS

April, 1927

Average Hourly Earnings (in Cents)	Number of Men							
	Drill-Press Oper.	Milling-Machine Oper.	Turret-Lathe Oper.	Screw-Machine Oper.	Engine Lathe Oper.	Planer Oper.	Boring-Mill Oper.	Combined Occupations
26 and under 28....	2	1						3
28 and under 30....	2	1						3
30 and under 32....	2							2
32 and under 34....	2							2
34 and under 36....	1	2		2	1			6
36 and under 38....	2	1						3
38 and under 40....	3			2	1			6
40 and under 42....	3	1			2		1	7
42 and under 44....	2	2	3	1	1			9
44 and under 46....	5	2	2	3	2		1	15
46 and under 48....	7	6	2	6	2		1	24
48 and under 50....	6	3		4	1	2		16
50 and under 52....	11	2	4	7	4		8	36
52 and under 54....	11	3	2	3	4		2	25
54 and under 56....	13	7	3	4	18	1	2	48
56 and under 58....	11	2	1	6	11	2	4	37
58 and under 60....	6	5	2	7	10	3	4	37
60 and under 62....	11	17	6	9	21	4	2	70
62 and under 64....	13	19	6	12	12	2	5	69
64 and under 66....	17	11	14	15	44	7	12	120
66 and under 68....	14	9	11	13	19	3	8	77
68 and under 70....	18	12	7	17	18	3	6	81
70 and under 72....	16	19	12	18	31	1	12	109
72 and under 74....	12	10	5	16	19	6	8	76
74 and under 76....	10	13	11	25	29	9	15	112
76 and under 78....	10	10	5	15	30	3	12	85
78 and under 80....	9	11	4	22	19	4	10	79
80 and under 82....	6	11	6	10	26	1	6	66
82 and under 84....	7	5	2	8	5	2	1	30
84 and under 86....	3	5	4	9	11	1	5	38
86 and under 88....	3	3	2	5	10	1	5	29
88 and under 90....	2	1	3	3	8		3	20
90 and under 92....		1	1	1	6		3	12
92 and under 94....	3				5		4	12
94 and under 96....	2	3		3	7		1	16
96 and under 98....		1	1	2	8			12
98 and under 100....		1		2	8			11
100 and under 102....		1			3	1		5
102 and under 104....		1		1	1			3
104 and under 106....			2	1	2		1	6
106 and under 108....					3		1	4
108 and under 110....		1		1	1	1		4
110 and under 112....			1	2	1			4
112 and under 114....					1		1	2
114 and under 116....				3			1	4
116 and under 118....		1	1		3	1	1	7

TABLE 1—(*Continued*)

Average Hourly Earnings (in Cents)	Number of Men							
	Drill-Press Oper.	Milling-Machine Oper.	Turret-Lathe Oper.	Screw-Machine Oper.	Engine-Lathe Oper.	Planer Oper.	Boring-Mill Oper.	Combined Occupations
118 and under 120....					1			1
120 and under 122....		1		1			1	3
122 and under 124....			1					1
124 and under 126....					1			1
126 and under 128....							1	1
128 and under 130....			1					1
130 and under 132....								
132 and under 134....		1			1			2
134 and under 136....							1	1
136 and under 138....								
138 and under 140....								
140 and under 142....					1			1
142 and under 144....								
144 and under 146....		1						1
146 and under 148....								
176 and under 178....				1				1
Total.....	245	207	125	260	412	58	149	1456

of 1456—it appears that the entire range in average hourly earnings is reduced by only 4 cents, while the range in actual weekly earnings is reduced by about $9.00, or to a spread of $56.00 rather than $65.00.

Turning to the individual occupations, Table 3 gives several measures of dispersion for both hourly and weekly earnings.

Several points may be noticed. First, the spread of hourly earnings is not uniform among the occupations. It varies in amount from 68 cents for drill-press and planer operating to $1.18 for milling-machine operating. Furthermore, the spread in the latter occupation is identical with that for the combined occupations. Second, there is no uniformity among the occupations as to either the lower or the upper limits

number of hours *equivalent* to the normal time of their plants. There is no way of telling whether, on a particular day, a man has worked overtime and short time on another day; but if the total hours actually worked correspond with the normal time of the plant, then the worker is classified as having worked the normal time of the plant.

TABLE 2

FREQUENCY DISTRIBUTION OF ACTUAL WEEKLY EARNINGS FOR SPECIFIED MACHINE-TOOL OCCUPATIONS

April, 1927

Actual Weekly Earnings (in Dollars)	Number of Men							
	Drill-Press Oper.	Milling-Machine Oper.	Turret-Lathe Oper.	Screw-Machine Oper.	Engine-Lathe Oper.	Planer Oper.	Boring-Mill Oper.	Combined Occupations
Under 10					2			2
10 and under 11								
11 and under 12	2					1		3
12 and under 13	1	1	1					3
13 and under 14	3	1		1	1			6
14 and under 15	3	1						4
15 and under 16	3	2	1				2	8
16 and under 17	2	2		2	1		1	8
17 and under 18	5		1	2	5		1	14
18 and under 19	2	1	1		4			8
19 and under 20		4	4	1	3	1	3	16
20 and under 21	5	1	2	1	2		3	14
21 and under 22	3	2	2	3	4		1	15
22 and under 23	4	5	2	4	1		2	18
23 and under 24	5	6	2	2	3	3	2	23
24 and under 25	15	4	4	4	2	2	2	33
25 and under 26	6	2		5	5		5	23
26 and under 27	9	7	6	6	9		3	40
27 and under 28	10	6	3	5	10		3	37
28 and under 29	10	5	2	11	14			42
29 and under 30	11	2	2	4	22	2	5	48
30 and under 31	8	11	8	10	16	3	4	60
31 and under 32	13	5	3	17	7	2	2	49
32 and under 33	11	9	6	16	22	1	2	67
33 and under 34	13	28	9	19	26	5	7	107
34 and under 35	13	7	8	18	22	1	6	75
35 and under 36	9	15	7	20	19	8	7	85
36 and under 37	7	11	4	26	29	4	7	88
37 and under 38	10	8	8	17	17	5	7	72
38 and under 39	5	8	4	14	18	4	14	67
39 and under 40	10	10	3	5	26	1	4	59
40 and under 41	9	7	4	5	8	2	7	42
41 and under 42	5	2	5	5	15	2	5	39
42 and under 43	3	1	1	4	6	3	6	24
43 and under 44	1	3	2	2	9	1	6	24
44 and under 45	7	3	1	3	11		3	28
45 and under 46	4	5	2	2	12		2	27
46 and under 47	3	2	2	7	5		3	22
47 and under 48	2	2	2	6	7	1	1	21
48 and under 49	2	3	2	1	8	1	3	20
49 and under 50	1			3	4		2	10
50 and under 51	5		3	2	2			12
51 and under 52	2	3		1	3	1	5	15
52 and under 53	1	3	1	2	3		3	13
53 and under 54		1	1		3		2	7
54 and under 55			1		2	1	1	5

TABLE 2—(*Continued*)

Actual Weekly Earnings (in Dollars)	Number of Men							
	Drill-Press Oper.	Milling-Machine Oper.	Turret-Lathe Oper.	Screw-Machine Oper.	Engine-Lathe Oper.	Planer Oper.	Boring Mill Oper.	Combined Occupations
55 and under 56	2				4			6
56 and under 57		1		1	7		1	10
57 and under 58				1	3			4
58 and under 59		1			2	1	1	5
59 and under 60		1						1
60 and under 61					1		1	2
61 and under 62			1					1
62 and under 63				1	1		1	3
63 and under 64			1		2		2	5
64 and under 65		1			2			3
65 and under 66			1					1
66 and under 67		2						2
67 and under 68			1		1			2
68 and under 69		1				1		2
69 and under 70								
70 and under 71		1						1
71 and under 72								
72 and under 73					1			1
73 and under 74						1		1
74 and under 75								
75 and under 76								
76 and under 77							1	1
77 and under 78								
78 and under 79			1					1
95 and under 96				1				1
Total	245	207	125	260	412	58	149	1456

of their respective ranges, the lower limits varying from 27 cents to 49 cents, and the upper from 95 cents to $1.45. In short, so far as both limits and amount of range are concerned, there is no uniformity among the occupations.

When the dispersion of average hourly earnings is expressed in terms of a summary figure instead of in terms of the entire range, there is a conspicuous similarity among the occupations. Thus it will be seen from Table 3 that the absolute standard deviation runs from 13.0 cents for turret-lathe operating to 15.6 cents for milling-machine operating.[3]

[3] An exception occurs with planer operating, but there are only 58 men in this occupation.

In view of the fact that the average hourly earning for each occupation is not the same (a fact to be considered presently), it is necessary to express the standard deviation as a percentage of the average. The resulting figure is the relative standard deviation. This varies from 19.5 per cent for screw-machine operation to 22.4 per cent for milling-machine.[3] Moreover, the relative for the combined occupa-

TABLE 3

SUMMARY OF MEASURES OF DISPERSION FOR SPECIFIED MACHINE-TOOL OCCUPATIONS

Occupation	Average Hourly Earnings				Actual Weekly Earnings			
	Entire Range		Standard Deviation		Entire Range		Standard Deviation	
	Limits*	Amount	Absolute	Relative	Limits†	Amount	Absolute	Relative
Drill-press operating	27– 95	68	13.6	21.3	11–55	44	9.00	27.9
Milling-machine operating	27–145	118	15.6	22.4	12–70	58	9.62	27.5
Turret-lathe operating	43–129	86	13.0	20.6	12–67	55	10.02	28.6
Screw-machine operating‡	35–121	86	14.0	19.5	13–62	49	7.31	20.9
Engine-lathe operating§	35–141	106	15.1	20.5	13–72	59	9.53	26.3
Planer operating	49–117	68	12.3	17.2	11–73	62	9.78	26.3
Boring-mill operating	41–135	94	15.2	20.5	15–76	61	10.23	27.0
Combined	27–145	118	15.0	21.2	11–76	65	9.72	27.3

* Measured from midpoint of class interval.
† Measured from midpoint of class interval; 50 cents understood.
‡ One extremely high earning removed.
§ Two extremely low earnings removed.

tions (21.2 per cent) is about the same as for the individual occupations. Therefore, while the dispersion occurs between different limits and while the spread is not identical among the occupations, the degree of dispersion as measured by the standard deviation is much the same in all cases.

In weekly earnings the range varies in amount from $44.00 in drill-press operating to $61.00 and $62.00 in boring-mill and planer operating respectively, or a difference of about $18.00. The lower limits above which these various spreads occur are much the same, running from $11.00

to $15.00, but there is less uniformity among the upper limits, which run from $62.00 to $76.00.

If, instead of considering the limits and the entire spread of actual weekly earnings, attention is centered on a summary figure of dispersion, it appears that the degree of dispersion is also much the same for the several occupations. The standard deviation varies only from $9.00 to $10.23 on an absolute basis, or from 27.3 per cent to 28.6 per cent on a relative basis, except for screw-machine operating, where the relative figure is 20.9 per cent. Furthermore, the relative for the combined occupations (27.3 per cent) is quite in line with that for the individual occupations.

In comparing the differences in hourly and weekly earnings for the several occupations, it will be noticed that the relative standard deviation for weekly earnings is larger in every instance than that for hourly earnings. This difference is not surprising because the influence of variations in working time affect weekly earnings more directly and to a more marked degree than hourly earnings.

The analysis in later chapters will frequently begin by showing certain tendencies for the combined occupations and then pursuing the analysis in the individual occupations. Part of the justification for this procedure is the fact that the dispersion for the combined occupations as shown by Table 3, is about the same as for most of the individual occupations.

Whether, if wages were proportionate to efficiency, such differences in earnings as are here shown would be more than those arising from differences in ability is not known. Some comments on this point will be made when the relation of method of wage payment to earnings is considered. But whatever the ultimate answer here may be, these differences in earnings will be accepted, for purposes of this study, as being sufficiently large to warrant an examination of certain influences in relation to them.

The second major point to be considered here is whether or not the general level of earnings is the same in the several

occupations. The answer to this question will determine in part whether or not, in the subsequent analysis, attention need be given to the individual occupations. These occupations are closely related both in their mechanical features and the qualifications of the workers and it has been shown that the dispersion of earnings is much the same among them. If, then, the general level of earnings is also similar, there would be some justification for considering the occupations only as a group.

TABLE 4

SUMMARY TABLE OF AVERAGE AND MEDIAN EARNINGS FOR SPECIFIED MACHINE-TOOL OCCUPATIONS

(1456 Men in Combined Occupations)

Occupation	Weekly Earnings			Hourly Earnings	
	Actual		Normal*		
	Average	Median	Average	Average	Median
Drill-press operating	$32.28	$32.22	$31.66	63.7c	65.3c
Milling-machine operating	34.93	33.95	34.40	69.5	69.2
Turret-lathe operating	35.52	34.43	36.96	71.9	70.1
Screw-machine operating	35.20	34.94	35.37	71.9	72.1
Engine-lathe operating	37.02	36.17	38.25	73.7	72.2
Planer operating	37.25	35.95	34.47	71.5	72.3
Boring-mill operating	37.68	37.92	39.37	74.0	73.7
Combined occupations	35.55	35.57	36.02	70.9	70.5

* Average hourly earnings for all the men in an occupation multiplied by the normal time of the plant.

From Table 4, which is a summary table of average [4] and median earnings in the selected occupations, several points may be noted. First, the difference between the lowest and the highest average actual weekly earnings is $5.40 and the difference for hourly earnings is 10.3 cents; in both instances the lowest earning is for drill-press operating and the highest for boring-mill operating. These differences of $5.40 for weekly and 10.3 cents for hourly earnings are about 15 per cent of the respective average earnings for the combined occupations, and it would seem that such differ-

[4] "Average" is used throughout as synonymous with "arithmetic mean."

TABLE 5

AVERAGE AND MEDIAN HOURLY EARNINGS IN SPECIFIED MACHINE-TOOL OCCUPATIONS AT SPECIFIED PERIODS OF TIME

Month	Year	Drill-Press Operating		Milling-Machine Operating		Turret-Lathe Operating		Screw-Machine Operating	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
Apr.	1927	64	65	70	69	71	70	72	72
Oct.	1926	59	60	66	65	65	66	67	68
Apr.	1926	59	59	64	64	63	65	66	66
Oct.	1925	58	60	61	64	63	63	64	64
Apr.	1925	55	56	64	64	61	61	64	63
Oct.	1924	59	60	62	62	59	55	63	63
Apr.	1924	57	56	60	61	60	61	61	61
Oct.	1923	56	55	63	64	64	64	63	63
Apr.	1923	54	55	60	58	54	52	63	64
Oct.	1922	50	50	56	55	54	55	61	61
Apr.	1920	51	51	56	55	55	54	63	65
Oct.	1919	51	50	55	55	53	51	56	55

Month	Year	Engine-Lathe Operating		Planer Operating		Boring-Mill Operating	
		Mean	Median	Mean	Median	Mean	Median
Apr.	1927	74	72	72	72	74	74
Oct.	1926	69	69	70	69	70	71
Apr.	1926	66	65	70	69	72	71
Oct.	1925	67	66	69	68	70	71
Apr.	1925	67	66	70	70	69	71
Oct.	1924	64	65	68	68	69	71
Apr.	1924	66	66	70	71	69	70
Oct.	1923	67	67	69	70	69	70
Apr.	1923	63	62	66	67	67	66
Oct.	1922	61	61	62	62	63	62
Apr.	1920	64	65	69	71	68	68
Oct.	1919	62	63	65	65	65	66

ences are sufficiently large to preclude a consideration of the occupations exclusively in combination. Second, the similarity of average and median earnings in nearly every occupation is striking. This suggests that, among other things, the distributions are well-balanced and that the average may be considered as a more representative figure than if this similarity did not exist. Third, on any of the five bases given in Table 4 the earnings for drill-press operating are the lowest and for boring-mill operating the highest. It there-

TABLE 6

SEQUENCE IN WHICH OCCUPATIONS OCCUR ON BASIS OF HOURLY EARNINGS
(Based on Table 5)

Average Earnings

Month	Year	Drill-Press Oper.	Milling-Machine Oper.	Turret-Lathe Oper.	Screw-Machine Oper.	Engine-Lathe Oper.	Planer Oper.	Boring-Mill Oper.
Apr.	1927	1	2	3	4–5	6–7	4–5	6–7
Oct.	1926	1	3	2	4	5	6–7	6–7
Apr.	1926	1	3	2	4–5	4–5	6	7
Oct.	1925	1	2	3	4	5	6	7
Apr.	1925	1	3–4	2	3–4	5	7	6
Oct.	1924	1–2	3	1–2	4	5	6	7
Apr.	1924	1	2–3	2–3	4	5	7	6
Oct.	1923	1	2–3	4	2–3	5	6–7	6–7
Apr.	1923	1–2	3	1–2	4–5	4–5	6	7
Oct.	1922	1	3	2	4–5	4–5	6	7
Apr.	1920	1	3	2	4	5	7	6
Oct.	1919	1	3	2	4	5	6–7	6–7

Median Earnings

Apr.	1927	1	2	3	4–5–6	4–5–6	4–5–6	7
Oct.	1926	1	2	3	4	5–6	5–6	7
Apr.	1926	1	2	3–4	5	3–4	6	7
Oct.	1925	1	3–4	2	3–4	5	6	7
Apr.	1925	1	4	2	3	5	6	7
Oct.	1924	2	3	1	4	5	6	7
Apr.	1924	1	2–3–4	2–3–4	2–3–4	5	7	6
Oct.	1923	1	3–4	3–4	2	5	6–7	6–7
Apr.	1923	2	3	1	5	4	7	6
Oct.	1922	1	2–3	2–3	4–5	4–5	6–7	6–7
Apr.	1920	1	3	2	4–5	4–5	7	6
Oct.	1919	1	3–4	2	3–4	5	6	7

fore appears that the occupations at each extreme are fairly well established. While there is some indication of a further sequence among the occupations, this becomes more definite in the light of additional information.

Such additional information is supplied by the semi-annual surveys of hourly earnings. Table 5 gives the average and median hourly earnings for each occupation in each of a series of periods extending from October 1919 to April 1927.[5]

[5] The data here are those supplied by the Metal Manufacturers' Association of Philadelphia, except for April 1927. This is the only place throughout the study where these data are used.

It will be noticed that in every instance there is a similarity of average and median earnings. This indicates that much the same stability in the distribution of hourly earnings exists in each period. In nearly every period drill-press operating is the lowest-paid occupation and boring-mill operating tends to be the highest, on the basis of either average or median earnings. This may be seen in Table 6, where the order of the occupations is given, beginning with the lowest-paid. Between drill-press operating and boring-mill operating there is a further sequence on the basis of which the occupations show a tendency to fall into the following groupings:

Drill-press operating

Milling-machine operating
Turret-lathe operating
Screw-machine operating

Engine-lathe operating

Planer-operating
Boring-mill operating

While the differences on which this sequence rests are not large, the persistence of it seems to indicate a stability in the relation existing among the occupations which is not likely to be found except when based on deeply-rooted forces. Substantially the same sequence could be shown on the basis of quartile hourly earnings.

Paralleling this grouping, there are fairly distinct differences both in the mechanical features of the machines and in the qualifications of the workers. Neither of these points will be considered here. It is sufficient to notice that, while the dispersion among these occupations is so nearly the same and there is so much that is common to the mechanical features of the machines and to the training and qualifications of the workers that, from a broad point of view, the occupations and the workers may be treated as a group, yet there are certain purposes for which they must be considered separately.

In this chapter it has been shown that earnings—hourly and weekly—are not uniform in any occupation. Moreover, the general level of earnings, as measured by average and median figures, is not the same for all occupations even though these occupations are closely related. At the same time there is considerable uniformity in the degree of dispersion among the occupations as measured by the relative standard deviation. It would seem that whatever the influences which contribute to differences in earnings, they are applicable to all the occupations. Whether or not these differences are greater than might be expected merely from differences in ability is not known, but the differences in earnings will be accepted as sufficiently large to warrant an examination of certain variables in relation to them. In the analysis of these variables reasons have been shown for centering attention on the individual occupations, although, from a broader point of view, there is also justification for treating them as a group.

CHAPTER II

HOURLY EARNINGS AMONG PLANTS

Among the assumptions found from time to time in reasoning concerning wages there is one to the effect that the price of labor in an occupation is uniform among employers in a locality. Sometimes this assumption is implied and at other times it is expressed. Thus, when a uniform piece rate is fixed for a certain type of work in an industry, whether by agreement or arbitration, it would seem that there is a tacit assumption that the workers in all establishments have equal opportunity under that rate. But the idea of uniformity is at times also expressed, as if wage rates for a given occupation usually varied little among different employers in the same locality, even though there might be considerable differences between localities.

In view of the fact that information is available regarding hourly earnings for particular occupations within the individual plants considered in this study, it is possible to ask what evidence there is that hourly earnings in an occupation are uniform among different employers.

Chart I shows, for each occupation, the average hourly earning for all the men in a plant and also the range of average hourly earnings within each plant. The horizontal line indicates the latter and the small vertical line shows the point along the range where the average occurs. For each occupation the plants are arranged in ascending order according to the average plant-earning.[1]

This chart shows two rather striking features. First, the average hourly earnings for all the men in an occupation are not the same, or approximately the same, in all plants. Sec-

[1] The average plant-earning for an occupation is the average for all the men in that occupation in a plant.

ond, while the spread in hourly earnings within individual plants is not uniform, there is a tendency for the entire level of earnings to follow the course of the average plant-earning when the plants are arranged in ascending order according to the average for the plant.

Considering the former point, the following summary table may be helpful, in that it gives the lowest and the highest average hourly plant-earning in each occupation, as well as the difference between the lowest and the highest, with a few exceptional instances disregarded.[2] Exclusive of

TABLE 7

SUMMARY TABLE SHOWING LOWEST AND HIGHEST AVERAGE HOURLY PLANT-EARNING AND THE DIFFERENCE BETWEEN THE LOWEST AND HIGHEST PLANT-EARNING IN SPECIFIED MACHINE-TOOL OCCUPATIONS

(In cents)

Occupation	Lowest Average Plant-Earning	Highest Average Plant-Earning	Difference between Lowest and Highest Plant-Earning
Drill-press operating	34.8	86.8	52.0
Milling-machine operating	40.8	92.5	51.7
Turret-lathe operating	51.3	90.9	39.6
Screw-machine operating	49.8	96.6	46.8
Engine-lathe operating	48.8	98.6	49.8
Planer-operating	60.0	79.1	19.1
Boring-mill operating	61.3	99.5	38.2

planer operating,[3] the smallest difference between the lowest and the highest average plant-earning is 38.2 cents in boring-mill operating and the greatest difference is 52.0 cents for drill-press operating. Thus it appears that there are appreciable differences in average plant-earnings for each of the occupations.

It also appears from Chart I that some firms show low

[2] In milling-machine operating the lowest average plant-earning is 27.1 cents while the next one above it is 40.8 cents; in planer operating the highest earning is 101.9 cents while the next one below it is 79.1 cents, and a similar situation occurs in turret-lathe and screw-machine operating. These average plant-earnings which are either followed or preceded by a decided break have been disregarded in the accompanying table.

[3] For planer operating the difference between the lowest and the highest average plant-earning is only 19.1 cents.

average plant-earnings rather consistently in all, or nearly all, the occupations which they reported, while other plants rather consistently show high average earnings. For example, plants 14, 37 and 710 are among those in which the average plant-earnings in all, or nearly all, the occupations reported are higher than in the other plants, while at the other extreme are plants 36, 53, 56, 57, 400 and 765.

Between these two extremes the bulk of the plants is found. Even though the difference between the lowest and the highest average plant-earning in an occupation varies from 38.2 cents in boring-mill operating to 52.0 cents in drill-press operating, there is a tendency for the average plant-earning of a considerable number of plants to occur at or between 65 cents and 75 cents, or within a spread of about 10 cents. The number and percentage of plants where this situation holds is shown by Table 8. The 1456 men distributed among the 43 plants treated in this study are engaged in 174 plant-occupations,[4] and for 97, or 56 per cent of them, the average earning occurs within the limits named. While the proportion is not the same in all the occupations, still it is fairly large in each, the lowest percentage being 42 in drill-press operating and the highest 71 in turret-lathe and planer operating. Thus it appears that in the various occupations an appreciable proportion of the plant-occupations produce average earnings falling at or between 65 cents and 75 cents, or within a range of 10 cents an hour.

This analysis suggests that (1) the average hourly plant-earnings for an occupation are not the same, or approximately the same, in all plants; (2) some plants have relatively low and others relatively high plant-earnings rather consistently. However, (3) in each occupation a very considerable proportion of the plants have average plant-earn-

[4] In this comparison a plant is counted as many times as it has different occupations. Thus a plant having all seven occupations is counted seven times in the total of 174 plant-occupations even though there is only one man in each occupation. For any one occupation a plant is counted only once.

TABLE 8

SUMMARY TABLE SHOWING NUMBER OF PLANTS REPORTING ONE OR MORE MEN IN AN OCCUPATION AND THE NUMBER AND PERCENTAGE OF PLANTS FOR WHICH THE AVERAGE PLANT-EARNING FALLS AT OR BETWEEN 65 CENTS AND 75 CENTS AN HOUR IN SPECIFIED MACHINE-TOOL OCCUPATIONS

Occupation	A*	B†	Percentage which B Is of A
Drill-press operating	31	13	42.0
Milling-machine operating	29	13	45.0
Turret-lathe operating	24	17	71.0
Screw-machine operating	19	9	47.0
Engine-lathe operating	35	22	63.0
Planer operating	17	12	71.0
Boring-mill operating	19	11	58.0
Combined occupations	174	97	56.0

*A—Number of plants reporting one or more men in an occupation.
†B—Number of plants for which the average plant-earning falls at or between 65 cents and 75 cents an hour.

ings at or between 65 cents and 75 cents, or within a range of about 10 cents an hour. This fact raises the general question of whether it may not be more accurate to speak of a tendency to a uniform range of rates rather than a uniform rate for an occupation among the plants in a locality.

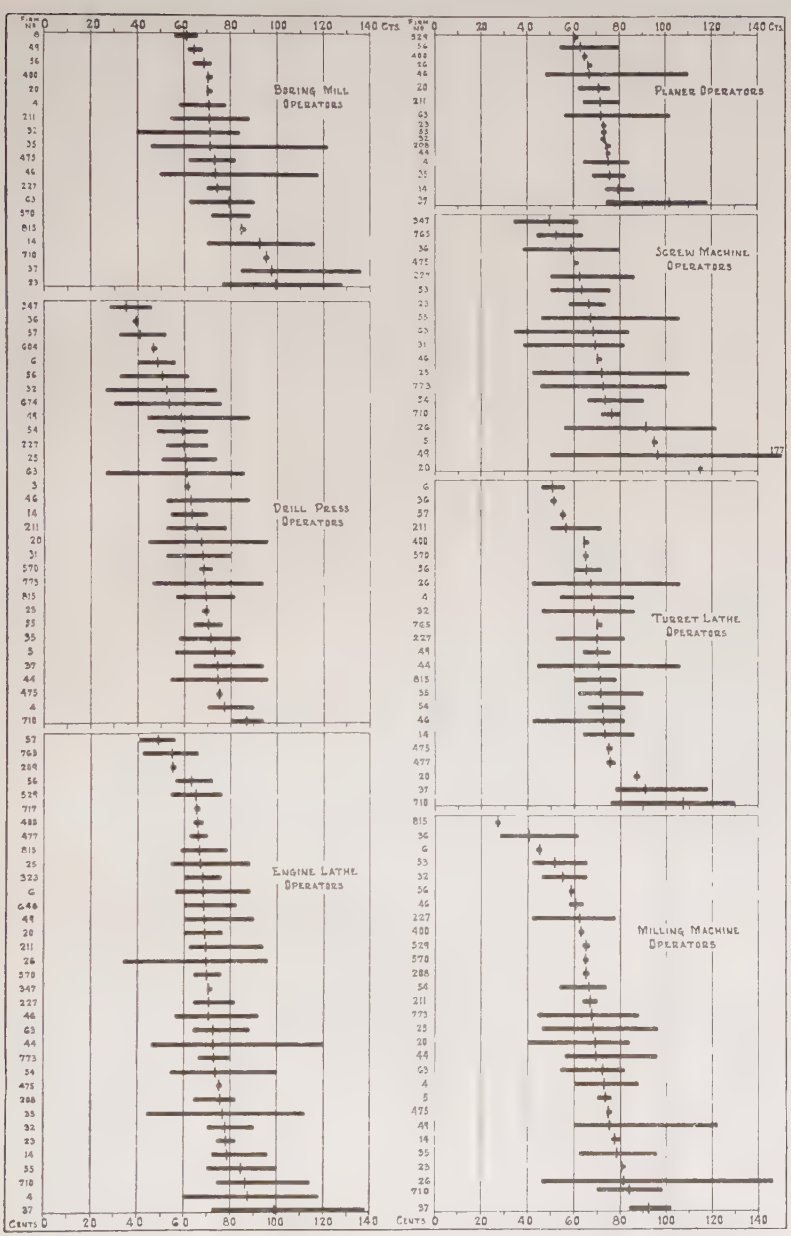

Chart I—Average and Spread of Hourly Plant-Earnings by Plants for Specified Machine-Tool Occupations
(Plants arranged in ascending order of average hourly plant-earning.)

CHAPTER III

RELATION OF METHOD OF WAGE PAYMENT TO EARNINGS

One of the forces related to wages is the amount of work performed within a given time. In order to increase the "exercised capacity" of the workers, different methods of wage payment have been used. While there has been considerable discussion of these methods, little attention has been given to them in either the collection or utilization of wage data. Frequently calculations and comparisons are made as though either there was only one method of payment or the different methods were of no consequence to actual wages.

It is the purpose of this chapter[1] to consider, first, the methods of payment actually used in conection with the selected occupations; second, what relation there is, if any, between method of payment and earnings; and, third, whether the technical features of these methods warrant certain wage comparisons and calculations which are often made.

Methods of Wage Payment

By an analysis of the 1456 cases in the seven selected occupations, as found among 43 plants, three general types of wage payment are disclosed. These are time, piece and bonus or premium methods. Time work is usually paid by a flat sum per hour for a specified number of hours a day or a week. Piece-work wages are based on a flat payment per unit of output without much direct regard to the time consumed. Bonus or premium methods involve a flat payment per hour for the time actually worked, plus an oppor-

[1] Analysis based entirely upon April 1927 data.

TABLE 9

CLASSIFICATION OF MEN IN SEVEN MACHINE-TOOL OCCUPATIONS BY PLANTS AND BY METHOD OF PAYMENT

Plant Number	Number of Men			
	Time	Piece	Bonus	Total
3	1			1
4	14		31	45
5	1	10		11
6	2	11		13
8	2			2
14	4		32	36
20	15	23		38
23			14	14
25	26	38		64
26	22		54	76
31	11			11
32		57		57
35	12	196		208
36	3	10		13
37	13		33	46
44	11		45	56
46		58		58
49	21		31	52
53	5	5		10
54	28	16		44
55	2		31	33
56	35			35
57	1		10	11
63	21	116		137
208	8			8
209		1		1
211	4		28	32
227	31			31
323	2			2
347	1	7		8
400	9			9
475	10			10
477	1	4		5
529	5			5
570	11		1	12
604	1			1
646	4			4
674		2		2
710			17	17
717	2			2
765	25			25
773	16	182		198
815		13		13
Total	380	749	327	1456

tunity for the worker to benefit by economies in the time consumed for a job.

Not only are there different methods of payment but each is used rather extensively, as may be seen by Table 9. About 52 per cent of the men are paid on a piece basis as compared with 26 per cent on a time and 22 per cent on a bonus basis. Even if allowance is made for the larger number of piece workers in three plants—494 men out of a total of 749—still the number of piece workers is quite large. It will be noticed incidentally that in no plant are all three methods of payment employed.

The percentages shown above—26, 52 and 22—for time, piece and bonus methods, respectively, are fairly represen-

	Actual Time Cases (1456)		Normal Time Cases (760)
	Average	Median	Average
Time	64.7c	65.1c	63.6c
Piece	70.6c	71.8c	69.4c
Bonus	78.7c	76.4c	77.8c

tative of the distribution among the several occupations, as may be seen by Table 10. In drill-press operating, for example, the percentages are 24, 58 and 18 respectively.

In short, these three general types of wage payment are used widely among both plants and occupations.

Relation of Method of Payment to Earnings

Even where different methods of payment are used, they might be disregarded in wage comparisons for some purposes if it were shown that the methods were irrelevant to earnings. It is with this possibility that we are now concerned.

On the basis of the combined occupations the average hourly earnings for piece and bonus workers show a tendency to be about 10 per cent and 20 per cent higher, respec-

tively, than the earnings for time workers. The average [2] for time work is 64.7 cents, for piece work 70.6 cents and for bonus work 78.7 cents. About the same situation holds on the basis of median earnings and also on the basis of average earnings for the 760 normal time cases.[3]

The situation with regard to average weekly earnings is about the same. Average earnings for time, piece and bonus work occur in the order just named and there tends to be a difference of 10 per cent and 20 per cent in favor of piece and bonus work respectively, as compared with time

TABLE 10

CLASSIFICATION OF NUMBER AND PERCENTAGE OF MEN BY METHOD OF PAYMENT IN SPECIFIED MACHINE-TOOL OCCUPATIONS

Occupation	Number of Men				Percentage of Men			
	Method of Payment			Total	Method of Payment			Total
	Time	Piece	Bonus		Time	Piece	Bonus	
Drill-press operating	59	142	44	245	24	58	18	100
Milling-machine operating	46	124	37	207	22	60	18	100
Turret-lathe operating	24	53	48	125	19	43	38	100
Screw-machine operating	58	150	52	260	22	58	20	100
Engine-lathe operating	148	161	103	412	36	39	25	100
Planer operating	23	16	19	58	40	28	32	100
Boring-machine operating	22	103	24	149	15	69	16	100
Combined occupations	380	749	327	1456	26	52	22	100

work. This sequence holds absolutely and the percentage differences tend to be very consistent on any one of the three bases given in the table following.

In the individual occupations the hourly earnings are, without exception, lowest for time work and highest for bonus work, as may be seen by Table 11. This is true whether the earnings be either the average or median for

[2] "Average" is used synonymously with "arithmetic mean."

[3] The expression "normal time cases" refers to those men who actually worked the equivalent of the normal time of their respective plants.

	Actual Time Cases (1456)		Normal Time Cases (760)
	Average Actual Earnings	Average Normal Earnings	Average Actual Earnings
Time	$32.53	$32.67	$32.17
Piece	36.23	35.79	34.34
Bonus	37.48	40.53	39.88

all the men in each occupation or the average for only those men who worked the normal time of their plants. From the same table it may be noticed that while the hourly earnings for piece and bonus work are not consistently 10 per

TABLE 11

SUMMARY TABLE OF AVERAGE AND MEDIAN HOURLY EARNINGS BY METHOD OF PAYMENT IN SPECIFIED MACHINE-TOOL OCCUPATIONS

Average Earnings

Occupations	Actual Time Cases*			Normal Time Cases†		
	Time	Piece	Bonus	Time	Piece	Bonus
Drill-press operating	59.2c	64.2c	68.0c	57.0c	61.3c	72.0c
Milling-machine operating	63.7	67.5	83.3	63.5	67.5	81.0
Turret-lathe operating	66.2	70.9	75.9	66.2	67.3	76.2
Screw-machine operating	64.3	72.1	80.0	64.1	71.2	73.9
Engine-lathe operating	66.0	76.1	81.0	65.5	76.0	80.6
Planer operating	66.3	71.2	78.0	63.5	67.1	76.3
Boring-mill operating	70.9	71.9	85.6	70.0	75.6	81.8
Combined occupations	64.7	70.6	78.7	63.6	69.4	77.8

Median Earnings

Occupations	Actual Time Cases*		
	Time	Piece	Bonus
Drill-press operating	60.0c	66.5c	69.0c
Milling-machine operating	63.1	70.1	78.7
Turret-lathe operating	65.6	69.3	71.5
Screw-machine operating	65.7	74.2	73.5
Engine-lathe operating	65.4	75.2	79.3
Planer operating	65.1	72.8	75.2
Boring-mill operating	71.3	73.0	84.0

* All men regardless of actual working time. Total cases, 1456.
† Only men who actually worked normal time of plant. Total cases, 760.

cent and 20 per cent higher, respectively, than for time work, these percentages are approximated rather generally.

Not only with workers but also with plants does this tendency to a sequence manifest itself. Table 12 gives the distribution of average hourly plant-earnings for each occupation by method of payment.[4] From this table it appears that there is a rather marked tendency for the general level of average plant-earnings to be higher for piece work than for time work, and higher for bonus than for piece work.

With average weekly earnings the situation is somewhat less definite than with average hourly earnings, although the sequence previously mentioned continues. Table 13 gives average weekly earnings, by method of payment, for each occupation and for the combined occupations as computed on three different bases.[5] For the combined occupations, on any one of the three bases, not only does the sequence hold but there is also a close approximation of the percentage differences. For example, the average earnings in Section A for time, piece and bonus work are $32.67, $35.79 and $40.53 respectively.

In the individual occupations the tendency to a sequence is quite marked, but the differences in favor of piece and bonus work are not consistently 10 per cent and 20 per cent higher respectively than for time work. Most of the exceptions to the sequence are found in Section B, where the influence of overtime and of short time is greatest.[6] In the

[4] Some plants are counted twice in an occupation because 23 of the 43 plants use more than one method of payment. Consequently a plant may have an average plant-earning for time work and also one for piece or bonus work.

[5] Section A gives the average weekly earnings for all the men in an occupation if they had worked the normal time of their plants at their average hourly earnings. Total cases, 1456. Section B gives the average actual weekly earnings for all the men in an occupation. Total cases, 1456. Section C gives the same type of data as Section B except that it applies to only those men who actually worked the equivalent of the normal time of their respective plants. Total cases, 760.

[6] This section gives the average actual weekly earnings for all the men in an occupation regardless of whether they worked overtime or short time.

TABLE 12

FREQUENCY DISTRIBUTION OF AVERAGE HOURLY PLANT-EARNINGS BY METHOD OF PAYMENT IN SPECIFIED MACHINE-TOOL OCCUPATIONS

Hourly Earnings (in Cents)	Drill-Press Operating			Milling-Machine Operating			Turret-Lathe Operating			Screw-Machine Operating			Engine-Lathe Operating			Planer Operating			Boring-Mill Operating		
	T	P	B	T	P	B	T	P	B	T	P	B	T	P	B	T	P	B	T	P	B
26 and under 28					1																
34 and under 36		1																			
36 and under 38																					
38 and under 40		1			1																
40 and under 42			1																		
42 and under 44																					
44 and under 46	1				1					1											
46 and under 48	1			1						1											
48 and under 50	1	1									1				1						
50 and under 52	1			1			2	2		1											
52 and under 54		2								1											
54 and under 56					1		1						2	1							
56 and under 58	1																				
58 and under 60	2			1																	
60 and under 62	1			2	1				1	2			1			1			1		
62 and under 64		4	2	3			1			3			4	1		1					
64 and under 66		1	1	3			3				1		3			2			1		
66 and under 68	1			2	2	1	1			1	1	1	5	3		1	1				
68 and under 70	3	3	1	1	2	1	1	1	1	2	2	1	5						1		
70 and under 72	1		1				2	2	2		1		2	1	3	1	1	1	3	2	2
72 and under 74		1			2			1	1	1	1		1	1			1	2	2	1	
74 and under 76	1		1	1		1	1						3	1		2		1	2		
76 and under 78			2			1						1		2							
78 and under 80				1	1		1								2		1	2		1	
80 and under 82						1		1					1		1						
82 and under 84	1																				
84 and under 86				1		1			1						1				1	1	
86 and under 88			1					1						2	1						1
88 and under 90	1																				
90 and under 92						1															
92 and under 94									1			1									1
94 and under 96						1					1										1
96 and under 98															1						
98 and under 100																					1
100 and under 102																		1			
102 and under 104						1															
104 and under 106																					
106 and under 108									1						1						
108 and under 110																					
110 and under 112																					
112 and under 114												1									
114 and under 116											1										
Total plant occupations	16	14	10	17	12	9	13	8	8	13	9	5	27	12	11	8	4	7	11	5	6

Code: T, Times; P, Piece; B, Bonus.

instances where the sequence does not hold it is generally true that the earnings for either piece or bonus work, and frequently both, are appreciably higher than the earnings for time work. There is only one case where the average for time work exceeds the average for both piece and bonus work.[7] Where the sequence does hold, the differences on

[7] Planer operating, Section B.

which it is based are sometimes rather small, but in other cases quite large.

In general it appears that the same tendency occurs in both hourly and weekly earnings, although the tendency is stronger in the former than the latter.

A factor which must be considered here is that where incentive methods of payment exist, particularly bonus or premium systems, a week may be too short a period in which to obtain an entirely representative sample, especially of weekly earnings. If a man is given a job on Friday with a standard time which runs until the following Tuesday, he will earn, if successful, some bonus in each of two weeks; but if the pay day is on Saturday he will receive the full bonus on the pay day following the completion of the work, even though a part of the bonus was actually earned the previous week. An accumulated bonus payment of this kind has appreciably less influence on the average hourly than on the actual weekly earnings. So far as this study is concerned, there is reason to believe that cumulative bonus payments have exerted much influence in a few instances, but not in a majority of the bonus cases.

Another point to be kept in mind is that over 50 per cent of the piece workers are in three plants. Only two of these plants employ exceptionally large percentages of piece workers in certain occupations. If these cases are removed, the average hourly earning for the piece workers in each of these occupations continues to exceed the average for time workers. It therefore appears that the conclusion reached concerning piece-work earnings is not appreciably influenced by the three plants with large numbers of piece workers.

Reference has been made to the fact that variations in actual from normal working time have much more influence on weekly than on hourly earnings. An attempt has been made to recognize the influence of such variations by giving average weekly earnings on three bases as in Table 13. There is, however, another type of variation in working time which must be considered, namely, differences in the normal

TABLE 13

SUMMARY TABLE OF AVERAGE WEEKLY EARNINGS BY METHOD OF PAYMENT FOR SPECIFIED MACHINE-TOOL OCCUPATIONS

Section A: Average Normal Earnings
(Total Cases: 1456)

Occupation	Method of Payment		
	Time	Piece	Bonus
Drill-press operating	$29.42	$31.52	$35.29
Milling-machine operating	32.30	32.60	43.15
Planer operating	35.07	37.45	40.25
Turret-lathe operating	34.23	37.15	38.18
Screw-machine operating	31.12	34.75	42.32
Engine-lathe operating	33.46	40.79	41.31
Boring-mill operating	37.29	38.61	44.43
Combined	32.67	35.79	40.53

Section B: Average Actual Earnings
(Total Cases: 1456)

Drill-press operating	$28.67	$33.90	$31.94
Milling-machine operating	31.57	34.13	41.81
Planer operating	38.29*	36.90	36.29
Turret-lathe operating	33.60	37.11	34.72
Screw-machine operating	31.43	35.12	39.62
Engine-lathe operating	33.27	39.96	37.80
Boring-mill operating	35.69	37.23	41.41
Combined	32.53	36.23	37.48

Section C: Average Actual Earnings†
(Total Cases: 760)

Drill-press operating	$27.93	$29.99	$36.80
Milling-machine operating	32.27	32.92	42.60
Planer operating	34.29	34.51	39.04
Turret-lathe operating	34.86	34.44	38.48
Screw-machine operating	31.01	34.30	39.14
Engine-lathe operating	33.33	39.63	40.64
Boring-mill operating	37.18	38.55	42.31
Combined	32.17	34.34	39.88

* Only instance in which average earning for time work exceeded average for both piece and bonus work.

† Includes only men who worked the normal time of their plants.

hours per week among plants. This type of variation will be considered more fully in a later chapter. At this time it is sufficient to recognize these differences by dividing the workers and plants into two groups: those with normal time of "under 50 hours" and those with normal time of "50 hours or more" per week. By this classification all plants and all workers are divided into nearly equal groups.

When differences in normal time are recognized in this manner, time earnings still tend to be lowest and bonus earnings to be highest. Table 14 gives the average hourly earnings, by method of payment, for the individual and for the combined occupations in each of the two periods of normal working time. Section A includes all workers and Section B only those who worked the normal time of their plants. For the combined occupations, throughout both sections, the sequence holds, although the percentage differences in favor of piece and bonus earnings, as compared with time earnings, is not consistently 10 per cent and 20 per cent respectively. However, in most instances these percentages are closely approximated or exceeded.

So far as the individual occupations are concerned, neither the sequence nor the percentage differences hold consistently. In both periods there are instances where there is either no difference, or the difference is small, between the average hourly earnings for time and piece workers or between piece and bonus workers. However, throughout both sections, the earnings for either piece or bonus workers in an occupation are higher by appreciable amounts than the earnings for time workers. In view of the minuteness of this classification, it is not surprising that the tendencies do not hold more consistently. Rather it is surprising that they hold as consistently as they do, since there is a total of only 1456 men in Section A and 760 in Section B separated into 42 combinations in each section.

In average weekly earnings the sequence holds and the percentage differences tend to hold for the combined occupations on each of three bases, as is shown in Table 15.

TABLE 14

SUMMARY TABLE OF AVERAGE HOURLY EARNINGS BY METHOD OF PAYMENT IN EACH OF TWO PERIODS OF NORMAL WORKING TIME, FOR SPECIFIED MACHINE-TOOL OCCUPATIONS

Section A

(Total Cases: 1456)

Occupation	Under 50 Hours per Week			50 Hours and Over per Week		
	Time	Piece	Bonus	Time	Piece	Bonus
Drill-press operating	61.7	66.3	73.2	55.4	56 7	64.0
Milling-machine operating	64.2	67.4	77.7	63.4	68.7	87.1
Planer operating	68.3	71.9	84.2	65 9	70.9	73.4
Turret-lathe operating	70.5	70 7	84.3	64.4	71.0	68.2
Screw-machine operating	65.9	72.7	76.2	58.3	53.8	80.1
Engine-lathe operating	68.4	72.5	88.2	64.6	76.5	74.2
Boring-mill operating	75.4	80 0	96.5	69 5	70.9	77.8
Combined	66.2	69 7	84.2	63.5	71.6	75.3

Section B

(Total Cases: 760)

Drill-press operating	59.5	64 6	74 0	52.5	52.2	69.0
Milling-machine operating	63.8	69.1	77.5	63.5	62.5	82.3
Planer operating	60 0	72 0	79 0	63 8	63 8	74.0
Turret-lathe operating	70 6	68.2	90.4	65.0	67 0	67.9
Screw-machine operating	66.9	71.6	76.0	54.6	58.7	73.7
Engine-lathe operating	67.0	73.1	83.2	64.7	77.2	77.6
Boring-mill operating	72.5	80.3	99.0	69.6	73.0	73.0
Combined	65.0	70.0	82.8	62.5	68.1	74.5

The bases on which data are given in this table are the same as those used in Table 13.

For the individual occupations it appears that the sequence holds very generally in the period "under 50 hours," but not nearly so generally for the period "50 hours and over." Incidentally, most of the instances where the sequence fails to hold for average hourly earnings are also in this latter period. These irregularities may be due in part to a failure adequately to control differences in normal working time. The two periods of normal working time as here used divide both plants and men into two equal groups, but the upper end of the range of normal working time is weighted

more heavily than the lower end, the greatest concentration of cases occurring at 48 and at 55 hours. The former is much closer to the median time of 50 hours than the latter. However, where the sequence does exist, it is generally based on differences of at least several dollars and there is only one instance throughout all three sections of the table where the average weekly earnings for time work exceed the average for both piece and bonus work.

In short, it appears that there is a direct relation between method of payment and both hourly and weekly earnings. Consequently, any disregard of different methods of payment in comparisons where their influence is pertinent cannot be based upon the assumption that these methods are merely different means to the same ends. Rather, method of payment must be thought of as a variable which influences wages.

Both interesting and important is the question: Are these differences in earnings proportionate to the abilities of the workers or do the differences in earnings reflect the effectiveness of the method of wage payment in stimulating the efficiency of the same grade of workers? Unfortunately the data on which this study is based can throw no light on this question.

There is, however, a striking similarity between the tendency to a 20 per cent difference in earnings for bonus workers as compared with time workers and certain observations in other fields. A recent experiment among the operators of taffy machines in England indicated a difference of about 20 per cent in the ability of workers to operate these machines.[8] There is also a tradition in the textile industry that a worker cannot be more than 20 per cent poorer than his fellow-weavers and still hold his place. Neither of these observations prove anything in connection with the question raised above, but both are suggestive, in that the tendency to a 20 per cent difference in earnings in certain occupations

[8] S. Wyatt, "Machine Speeds and Output," *Industrial Psychology*, October 1927.

TABLE 15

SUMMARY TABLE OF AVERAGE WEEKLY EARNINGS BY METHOD OF PAYMENT IN EACH OF TWO PERIODS OF NORMAL WORKING TIME, FOR SPECIFIED MACHINE-TOOL OCCUPATIONS

Section A: Average Normal Earnings
(Total Cases: 1456)

Occupation	Under 50 Hours			50 Hours and Over		
	Time	Piece	Bonus	Time	Piece	Bonus
Drill-press operating	$29.06	$31.82	$35.28	$29.58	$29.88	$35.07
Milling-machine operating	30.50	32.02	37.45	33.48	36.07	47.21
Planer operating	30.87	34.51	40.42	35.98	38.36	39.86
Turret-lathe operating	33.84	32.45	40.72	34.26	37.48	35.46
Screw-machine operating	31.37	34.90	37.72	30.20	28.30	42.45
Engine-lathe operating	32.76	34.22	42.51	33.85	41.46	39.85
Boring-mill operating	35.74	38.24	46.51	37.60	38.64	42.40
Combined	31.45	33.32	40.58	33.59	38.59	40.36

Section B: Average Actual Earnings
(Total Cases: 1456)

Drill-press operating	$27.67	$34.85	$31.62	$30.13	$30.52	$32.19
Milling-machine operating	29.77	33.98	35.47	32.73	34.92	46.13
Planer operating	40.76	34.52	34.36	37.77*	37.69	37.69
Turret-lathe operating	29.45	32.18	35.56	35.31	37.86	33.96
Screw-machine operating	31.51	35.41	37.72	31.12	26.74	39.70
Engine-lathe operating	31.09	34.75	37.47	34.56	40.46	38.10
Boring-mill operating	31.53	38.08	41.51	36.91	37.12	41.34
Combined	30.53	34.87	36.14	34.15	37.78	38.33

Section C: Average Actual Earnings†
(Total Cases: 760)

Drill-press operating	$27.96	$31.05	$35.73	$27.88	$27.30	$37.86
Milling-machine operating	30.53	33.15	37.30	33.45	31.83	44.72
Planer operating	27.45	34.53	37.97	34.82	34.49	39.93
Turret-lathe operating	33.92	31.13	44.11	35.12	35.29	35.16
Screw-machine operating	31.79	34.39	37.72	28.35	31.09	39.27
Engine-lathe operating	32.31	34.65	39.97	33.92	41.43	41.41
Boring-mill operating	34.80	38.08	47.56	37.66	38.82	39.68
Combined	30.96	33.53	39.95	33.11	36.04	39.83

* Only instance where time earnings exceed both piece and bonus earnings.
† Includes only men who worked the normal time of their plants.

may have a counterpart in a 20 per cent difference in the ability of workers.

Validity of Certain Calculations Involving Wage Rates

In the light of the foregoing analysis by which it appears that different methods of payment are used quite extensively and that hourly and weekly earnings are not the same under all methods, it is particularly pertinent to inquire further concerning the validity of certain calculations and comparisons which are made on the basis of *wage rates.*

Just what the term "wage rate" means is not always clear, for it has no standard meaning. But the way in which it is often employed implies that it refers to hourly base rates.[9] This seems to be the sense in which the term is used when in some instances it is assumed that "with normal employment, rates may be calculated from earnings and earnings from rates." Presumably the term "earnings" refers to some period of time such as a week, so that the assumption really is that hourly base rates may be calculated from weekly earnings and weekly earnings from hourly base rates.

When a time method of payment is involved, the comparisons of base rates and the calculation of rates from earnings and earnings from rates has its greatest significance. Here the unit of comparison, an hour, is uniform, and if the normal working time is also uniform and employment is regular, then earnings may be calculated from base rates and base rates may be approximated from earnings. If the hourly rate is 60 cents and if the employees work the normal time of the plant, say 50 hours per week, their weekly earnings would be $30.00, and if only the weekly earnings and working time were known, the average earned rate would be identical with the base rate. Thus the base rate might be said to have been calculated from the earnings.

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[9] Average hourly earnings as used in this study are sometimes referred to as hourly earned rates. Such rates may or may not coincide with hourly base or nominal rates.

Where piece work is involved, it is quite impossible to make any general comparisons of base rates and equally impossible to calculate such rates from earnings and earnings from rates. Piece rates must first be converted into hourly earned rates (hourly earnings) for general comparisons and calculations. With the present data, about 50 per cent of the cases would have had to be discarded if only base rates had been known.

Where a bonus method of payment is involved, the situation is not so clear. Here the difficulty seems to arise from the fact that with this method of payment, as with a straight time method, there is an hourly base rate. This similarity gives rise to the assumption that the same comparisons and calculations may be made on the basis of the hourly rates of a bonus system as may be made with the hourly rates of a straight time method of payment. It is to this point especially that attention is here given.

The reason base rates may not be, and indeed are not likely to be, comparable in the two cases is that on a time basis there are only two elements directly involved in the computation of earnings: base rate and time. In bonus earnings, on the other hand, a third element, standard production, is added in the immediate calculation of earnings. It is the addition of this third factor which is very likely to destroy the comparability of base rates for time work with base rates for bonus work.

Bonus systems were designed to stimulate the efficiency of the workers, but with three variables through which the efficiency of the worker may be stimulated, there is room for differences of opinion about the relative merits of these variables to this end. Consequently, bonus or premium plans differ in several regards. First, and perhaps most important, is the manner in which the "standard time" is set. Some plants set their standards on the basis of a careful study of the time required to manufacture each and every unit of a product, while other plants set their standards by "judgment" and "common sense." One plant may make an al-

lowance of 10 per cent and another of 25 per cent on the time in which the job is actually expected to be completed. In short, there is no uniformity in the method of determining "standard time" and, with other things equal, a liberal standard time is more attractive to workers than a close standard.

The second respect in which bonus plans differ is in the basis on which the workers benefit by economies in time. One plant gives the worker full benefit, at his usual base rate, for all time saved; another plant gives the worker the benefit of some portion of the time saved, perhaps 50 per cent, at his usual base rate, while a third plant gives the worker the full benefit of time saved but at a special rate. This special rate may be 30 cents an hour whereas the usual base rate for the time actually worked is 65 cents an hour. Here again, with other things equal, the most liberal basis would result in the highest earnings for a given period of time, and therefore be most attractive to workers.

There is a third respect in which bonus plans may differ. That is the manner in which the base rate is adjusted to the other variables. One plant may pay a higher base rate than some other plants, but set standards rather rigidly, while another plant may pay a very low base rate but make extremely liberal allowances in establishing standard time. Thus one plant manufacturing a nationally-known product has a base rate of about 55 cents an hour for an occupation in which the average hourly earning for the market is considerably higher. The management recognizes that the men in this occupation must receive about 70 cents an hour with reasonably regular work if they are to be held. Rather than change the base rate—and give the impression, perhaps, of increasing wage levels—this management believes it wise to make the necessary adjustments with the other variables in the incentive system used in that plant.

No thought of evaluating the various bonus plans is here entertained. The only point involved is that, with these variations in bonus plans, there is abundant reason to believe,

even if nothing were known of the general influence of bonus methods on earnings, that the base rate for time work would not be comparable with the base rate for bonus work. In the absence of overtime at a special rate, the hourly rate for time work is identical with the hourly earnings, but the base rate for bonus work is not necessarily, and indeed not likely to be, identical with the hourly earnings for bonus work.

It seems, therefore, that with the methods of payment here considered, there are difficulties in making comparisons of base rates and in calculating rates from earnings and earnings from rates. Moreover, the methods presenting these technical difficulties are too widely used to be disregarded as of negligible importance. Except for time work, under certain circumstances, general comparisons of rates are likely to have significance only when they are made in terms of earned rates.

The analysis of this chapter leads to the conclusion that there appears to be an important relation between methods of payment and both hourly and weekly earnings, especially in view of the extent to which different methods of payment are used. A marked tendency has been noted for time earnings to be lowest and bonus earnings highest. The sequence of time, piece and bonus earnings tends to rest on a difference of about 10 per cent and 20 per cent for piece and bonus earnings as compared with time earnings. Thus instead of being a fixed factor, the method of payment is a variable one and as such calls for greater attention than it generally receives. The technical features of piece and bonus methods make certain comparisons of base rates either impossible or highly questionable and this is also true of the calculation of base rates from earnings and earnings from base rates. Where different methods of payment are used and where general comparisons are involved, it would seem that the earned rather than the base rate is the significant figure.

CHAPTER IV

NORMAL TIME AND ITS RELATION TO EARNINGS

The expression "normal working time" has a rather prominent place in wage discussions, although its meaning is often uncertain. There is reason to believe that it frequently contains two fairly distinct ideas. Sometimes it refers to the number of hours which constitute the full-time operation of the plant in a given period, say a week, and carries the implication that this number of hours is the same for all the workers in a given occupation in a market. At other times the expression seems to mean that the hours actually worked correspond with the number constituting full-time operation.

Throughout this study the expression "normal time" will mean the number of hours per week which constitute full-time operation. In the present chapter attention will be given to the assumption that normal time is uniform for an occupation in a locality. The next chapter will consider the relation of actual to normal time.

Differences in Normal Time Per Week

Judging by the plants covered in this study, there is no uniform period of normal time for the workers in the selected occupations. Within individual plants there is a uniform time for the operators,[1] but as among plants there is considerable variation. The maximum range is from 44 to 55 hours per week,[2] as may be seen by Table 16. This range is found not only in the data for April 1927 but also in those for the years 1925 and 1926.

[1] A few men in one plant constitute the only exception. See footnote, Table 16.

[2] Accurately stated, these limits are "44 and under 45" and "55 and under 56." For convenience, the lower limit of the interval will be used.

While there is a maximum difference in normal time of 11 hours, this spread is slightly reduced if one considers the limits within which there is consecutive distribution. Here the range is from 48 to 55, with the largest number of men and of plants at the former and the second largest number at the latter figure. With this reduction there is still a difference of 7 hours per week in the normal time of the plants, and it would seem that such a difference is sufficiently

TABLE 16

DISTRIBUTION OF NUMBER OF HOURS CONSTITUTING NORMAL TIME PER WEEK BY NUMBER AND PERCENTAGE OF MEN AND OF PLANTS FOR STANDARD MACHINE-TOOL OCCUPATIONS

(April, 1927)

Number of Hours Constituting Normal Time per Week	Men		Plants	
	Number	Percentage	Number	Percentage
44 and under 45	11	1	1	2
45 and under 46	56	4	3*	7
46 and under 47				
47 and under 48				
48 and under 49	585	40	10	23
49 and under 50	47	3	6	14
50 and under 51	69	5	2	5
51 and under 52	76	5	3	7
52 and under 53	100	7	4	9
53 and under 54	61	4	1	2
54 and under 55	86	6	5	12
55 and under 56	365	25	8	19
Total	1456	100	43	100

* One of these plants had a few men on a 50-hour basis.

large to have an important relation to hourly and weekly earnings.

RELATION OF DIFFERENCES IN NORMAL TIME PER WEEK TO HOURLY AND WEEKLY EARNINGS

Granted that there are differences in the normal working time of plants, how is this fact related to hourly and weekly earnings? Here there is a difference of opinion. By some it is argued that the hourly price of labor tends to increase as the duration of the working period increases. Thus the

hourly price would be higher in a plant with a normal week of 55 hours than in a plant with 48 hours as the normal week. Others argue that within the customary limits of working time, the hourly price of labor tends to remain the same. Still others contend that the price per hour tends to decrease as the duration of the working period increases.

The first of these views is suggested by both Marshall and Pigou. Marshall contends that the hourly rate of pay will be sufficient to compensate "for the last, and most distressing hour."[3] And Pigou observes that where working time is not uniform, there is not a single demand and a single supply price. Rather there is a series of demand and of supply prices. These demand prices are "greater or less according as the work is done in longer or shorter day spells. . . . In like manner, there is a series of supply prices for this same aggregate quantity of hours, which are also greater or less according as the work is to be done in longer or shorter day spells."[4] According to this line of reasoning, the hourly price of labor increases as the duration of the working time increases.

The second view, *i.e.*, that the hourly price of labor tends to be the same in all plants regardless of the duration of working time, is not so frequently expressed as it is implied. That there is no direct relation between these two factors is implied when the average hourly earnings for an occupation in one plant are compared with those in another, even though the working time in the two plants is different, or when the earnings of one plant are compared with those in the market generally, even though it is known that all plants do not have the same working time.

The third view, *i.e.*, that the hourly price of labor tends to decrease as the duration of working time increases, is expressed from time to time by those in the market place,

[3] *Principles of Economics*, p. 527.

[4] *Economics of Welfare* (1920 edition), pp. 415-16. This statement appears to have been removed in the most recent edition.

but it is heard much less frequently than the immediately preceding view.

The importance of these points may be illustrated by hypothetical cases. Assume two plants to have the same base rate of 60 cents per hour for approximately the same work. The one plant operates 48 hours per week and the other operates 52 hours. The weekly earnings of a full-time man in the first plant are $28.80, while the man in the second plant receives $31.20. Over a period of 50 weeks this difference amounts to $120.00, which means, other things being equal in the two plants, that the man in the 48-hour plant loses the earnings of about four weeks in the year. True, he does not work those four weeks, but it is highly questionable whether a man whose weekly earnings are in the neighborhood of $30.00 will have such a high regard for leisure that he is willing to sacrifice the income of more than a month's work to gain that leisure.

Now suppose a worker in the 52-hour plant received a higher hourly earning than the worker in the 48-hour plant; the difference in weekly and yearly earnings would be even greater. Assuming a premium of one cent an hour for each hour over 48, there would be a difference of about $224.00 in the yearly earnings of the two men. This means that the man in the 48-hour plant loses about two months of possible working time in the course of a year.

Assume, finally, that instead of a premium of 1 cent an hour for each hour over 48, there is a discount of 1 cent. The hourly price then is 60 cents in the 48-hour plant and 56 cents in the 52-hour plant. This means that the man in the former plant earns $29.12 a week and the man in the latter plant $28.80. It is true that the man who works the longer period earns more than the other man, but the difference in favor of the first man is only 32 cents. Thus the four additional hours are worked at an average price of 8 cents an hour. Viewing the situation in terms of a year, the man in the 52-hour plant works about four weeks more than the other man for about the same money.

In these three cases a difference of only four hours per week has been assumed. When the maximum difference is 11 hours, or nearly three times that assumed, the disparity in each case would be even greater than that given above.

In analyzing the relation of differences in working time to earnings, the normal time of plants will be combined into two periods: "under 50 hours" and "50 hours and over" per week. This separation divides both the men and the plants about equally, as may be seen below.

	Number of Men	Number of Plants	Number of Man Hours	
			Total Actual	Total Normal
Under 50 hours per week	724	20	33,280	33,181
50 hours and over per week	732	23	39,980	40,815
Total	1456	43	73,260	73,996

Moreover, the total actual and the total man hours are about the same in each period, so that, in the aggregate, actual and normal time correspond quite closely.

In considering the relation of differences in normal time to hourly and weekly earnings, attention will first center on Table 17. This is a summary table of average earnings in each of two periods of normal time. The averages in Section A are based on all the men in an occupation and those in Section B are based on only those men who worked the normal time of their plants. In both sections the hourly earnings are given in sub-section I and the actual weekly earnings in sub-section II. Section A-III gives the average earnings if all the men *had* worked the normal time of their plants at their actual average hourly earning.

From this table it appears that the average hourly earnings are higher in the shorter than in the longer period. In Section A-I the averages for the combined occupations are 71.5 cents in the former and 70.3 cents in the latter period, while in Section B-I they are 70.8 cents and 67.8 cents respectively. In the individual occupations this same tend-

ency holds, but not without exceptions. There are fourteen comparisons in Section A-I and B-I and in only three of them does the tendency fail to show itself.

TABLE 17

SUMMARY TABLE OF AVERAGE EARNINGS IN EACH OF TWO PERIODS OF NORMAL WORKING TIME FOR SPECIFIED MACHINE-TOOL OCCUPATIONS

Occupation	Section A–I Average Hourly Earnings		Section A–II Average Actual Weekly Earnings		Section A–III Average Normal Weekly Earnings	
	Under 50	50 and Over	Under 50	50 and Over	Under 50	50 and Over
Drill-press operating	66.1	58.6	32.95	30.93	31.66	31.41
Milling-machine operating	68.1	72.2	33.59	37.56	32.42	38.41
Turret-lathe operating	79.1	68.9	33.76	36.26	37.81	36.45
Screw-machine operating	71.1	74.2	34.50	37.19	34.06	39.18
Engine-lathe operating	77.2	72.3	34.20	38.16	36.98	38.16
Planer operating	77.2	69.3	36.00	37.70	36.52	37.70
Boring-mill operating	85.3	71.5	38.14	37.58	40.77	38.90
Combined occupations	71.5	70.3	34.04	36.92	34.18	37.68

Occupation	Section B–I Average Hourly Earnings		Section B–II Average Actual Weekly Earnings	
	Under 50	50 and Over	Under 50	50 and Over
Drill-press operating	64.3	56.0	30.73	29.71
Milling-machine operating	68.8	69.5	33.03	36.81
Turret-lathe operating	80.9	66.8	38.81	35.26
Screw-machine operating	70.5	67.2	33.78	35.55
Engine-lathe operating	74.7	71.4	35.83	37.87
Planer operating	74.3	66.2	35.54	35.97
Boring-mill operating	83.4	72.2	39.82	38.70
Combined occupations	70.8	67.8	33.90	36.03

Average weekly earnings, on the other hand, tend to be lower in the shorter than in the longer period. In Section A-II the average for the combined occupations is $34.04 in the shorter and $36.92 in the longer period and sub-

stantially the same average weekly earnings are shown in Sections B-II and A-III.

While there are indications of this tendency in the individual occupations, it is subject to rather numerous exceptions. In the three sections just referred to there are 21 comparisons and the tendency holds in only 13 of them, or in about 66 per cent of all the cases.

In view of the fact that different methods of payment were used and that the hourly and weekly earnings vary with each of the methods, allowance has been made for this variable in Table 18. Here the same type of information is given as in the preceding table except that the data are further classified on the basis of time, piece and bonus methods of payment.

The same tendencies, subject, however, to numerous exceptions, may be noticed here as were previously shown. Average hourly earnings are higher in the shorter than in the longer period under all methods of payment in Sections A-I and B-I except piece work in Section A-I, where the average (71.6 cents) is 1.9 cents greater in the longer than in the shorter period (69.7 cents).

In the individual occupations the tendency continues with exceptions. In all but eight of the 42 comparisons which may be made in Sections A-I and B-I, the average hourly earnings tend to be higher in the shorter than in the longer period. The differences in favor of the shorter period are frequently 5 cents or more, while in only a few instances are the differences very small. Most of the exceptions to the general tendency occur in piece work. Reference to Table 16 shows that there are three plants with relatively large numbers of piece workers and it so happens that the normal time of two of these plants occurs in the one period and of the remaining plant in the other period. This fact may contribute to the exceptions noticed in connection with piece work.

On the basis of average weekly earnings, the earnings still tend to be larger in the longer than in the shorter period.

TABLE 18

SUMMARY TABLE OF AVERAGE EARNINGS BY METHOD OF PAYMENT IN EACH OF TWO PERIODS OF NORMAL WORKING TIME FOR SPECIFIED MACHINE-TOOL OCCUPATIONS

Occupations	Actual Time Cases*						Normal Time Cases†			
	Section A–I Average Hourly Earnings		Section A–II Average Actual Weekly Earnings		Section A–III Average Normal Weekly Earnings		Section B–I Average Hourly Earnings		Section B–II Average Actual Weekly Earnings	
	Under 50	50 and Over	Under 50	50 and Over	Under 50	50 and Over	Under 50	50 and Over	Under 50	50 and Over
	Time									
Drill-press operating	61.7	55.4	27.67	30.13	29.06	29.58	59.5	52.5	27.96	27.88
Milling-machine operating	64.2	63.4	29.77	32.73	30.50	33.48	63.8	63.5	30.53	33.45
Turret-lathe operating	70.5	64.4	29.45	35.31	33.84	34.26	70.6	65.0	33.92	35.12
Screw-machine operating	65.9	58.3	31.51	31.12	31.27	30.20	66.9	54.6	31.79	28.35
Engine-lathe operating	68.4	64.6	31.09	34.56	32.76	33.85	67.0	64.7	32.21	33.92
Planer operating	68.3	65.9	40.76	37.77	30.87	35.98	60.0	63.8	27.45	34.82
Boring-mill operating	75.4	69.5	31.53	36.91	35.74	37.60	72.5	69.6	34.80	37.66
Combined occupations	66.2	63.5	30.53	34.15	31.45	33.59	65.0	62.5	30.96	33.11

Piece

Drill-press operating	66.3	56.7	34.85	30.52	31.82	29.88	64.6	52.2	31.05	27.30
Milling-machine operating	67.4	68.7	33.98	34.92	32.02	36.07	69.1	62.5	33.15	31.83
Turret-lathe operating	70.7	71.0	32.18	37.86	32.45	37.84	68.2	67.0	31.13	35.29
Screw-machine operating	72.7	53.8	35.41	26.74	34.90	28.30	71.6	58.7	34.39	31.06
Engine-lathe operating	72.5	72.6	34.75	40.46	34.22	41.46	73.1	77.2	34.65	41.43
Planer operator	71.9	70.9	34.52	37.69	34.51	38.36	72.0	63.8	34.53	34.49
Boring-mill operating	80.0	70.9	38.08	37.12	38.24	38.64	80.0	73.0	38.08	38.82
Combined occupations	69.7	71.6	34.87	37.78	33.32	38.59	70.0	68.1	33.53	36.04

Bonus

Drill-press operating	73.2	64.0	31.62	32.19	35.28	35.07	74.0	69.0	35.73	37.86
Milling-machine operating	77.7	87.5	35.47	46.13	37.45	47.21	77.5	82.3	37.30	44.72
Turret-lathe operating	84.3	68.2	35.56	33.96	40.72	35.46	90.4	67.9	44.11	35.16
Screw-machine operating	76.2	80.1	37.72	39.70	37.72	42.45	76.0	73.7	37.72	39.27
Engine-lathe operating	88.2	74.2	37.47	38.10	42.51	39.85	83.2	77.6	39.97	41.41
Planer operating	84.2	73.4	34.36	37.69	40.42	39.86	79.0	74.0	37.97	39.93
Boring-mill operating	96.5	77.8	41.51	41.34	46.51	42.40	99.0	73.0	47.56	39.68
Combined occupations	84.2	75.3	36.14	38.33	40.58	40.36	82.8	74.5	39.95	39.83

* Total cases, 1456.
† Total cases, 760.

This tendency holds for the combined occupations throughout Section A-II and the only exceptions in Sections A-III and B-II occur in bonus work, where the average is nearly the same in both periods.

In the individual occupations the tendency also manifests itself, subject to exceptions. Out of 63 comparisons (Sections A-II, A-III and B-II) there are 40 in which the tendency holds, although in about 12 of these 40 the differences are so small that there is justification for considering the earnings approximately the same in both periods.

While there have been rather numerous exceptions to the tendency for weekly earnings to vary directly with the duration of working time, several points must be remembered. First, variations in working time affect weekly earnings more noticeably than hourly earnings. Even though attempts have been made to control these differences in working time, the control may have been inadequate. In the second place, and related to the former, is the fact that at best there are only 1456 cases on which this rather minute analysis rests.

The analysis of this chapter indicates two major points. First, there are rather marked differences in the standard or normal working time of plants in a single market. Second, this fact has an important bearing on hourly and weekly earnings. Hourly earnings show a pronounced tendency to vary inversely, while weekly earnings show a less pronounced tendency to vary directly with the duration of working time. When, therefore, the expression "normal time" relates to the standard time of plants, it is important to know whether or not that time is uniform. If not, differences in normal time may have to be taken into account in wage analyses and comparisons.

CHAPTER V

RELATION OF VARIATIONS BETWEEN ACTUAL AND NORMAL TIME TO EARNINGS

In addition to the meaning attached to the expression "normal working time" in the preceding chapter and throughout this study, one often encounters the expression as meaning that the number of hours actually worked corresponds with the number of hours which constitute full-time operation. It is with this idea that the present chapter deals.

On the basis of the data here being considered, there is little or no reason to believe that the normal time of plants reflects the actual working time of the employees. Out of 1456 men reported in April 1927, only 760 or about 52 per cent worked the normal time of their plants. Furthermore, the discrepancy between actual and normal seems to be even greater when a longer period of time is considered. In both 1925 and 1926 only about 9 per cent of the men who worked at least 49 weeks during the calendar year worked an average number of hours per week equivalent to the normal time of the plant.[1]

From Table 19 the situation may be seen as it is found in individual plants. This is a summary table of working

[1] There may be some doubt whether the situation in April 1927 is actually as favorable, compared with 1925 and 1926, as the figures above indicate. In April 1927 no allowance has been made for entrances to and exits from a plant during the week covered. This omission may tend to accentuate the amount of short time in a particular week. On the other hand, it is usually wise, in taking a sample covering a period of a week, deliberately to avoid a week in which losses of time are likely to occur through holidays, taking of inventory, etc. This precaution tends to minimize the importance of short time. Whatever allowances may be made in either direction, it seems fairly evident that an appreciable proportion of the workers in all three periods did not work the equivalent of the normal time of their plant.

time by plants for the three periods of time—1925, 1926 and April 1927. In each of these periods the plants are arranged in ascending order according to their normal time.[2] At the extreme left of the table there is a range of hours in intervals of one hour. The normal time of each plant is shown by two heavy horizontal lines which bound the interval in which the normal time of that plant occurs. Only in April 1927 are there any instances in which all the men in a plant worked the normal time of that plant. This is the case in 11 of the 43 plants employing 296 of the 1456 men. In 1925 and 1926, where the data are on a yearly basis, there is not one plant where all the men worked the equivalent of the normal time of the plant. Except in those plants where in 1927 all the men worked the normal time, there is usually a rather marked variation in the actual working time. Notice, for example, the spread of hours shown for plants 37 and 18 in 1925, plants 52 and 63 in 1926, and plants 20,773, 26, 46, and 35 in April 1927.

Even though a considerable proportion of the men in a plant may not work the normal time, the average actual working time of the plant may correspond with its normal time. But it does so in very few instances. At the bottom of Table 19 the average actual time is given and the asterisk in each column shows the relation of this average to the normal time of the plant. If the average actual and the normal time correspond, then the asterisk falls between the two heavy lines showing the normal time of the plant. It will be noticed that, during April 1927, in 13 of the 43 plants the average actual time about equals[3] their normal time; while in 1926 this was true of one plant and in 1925 there was not a single instance among the 10 plants.[4]

Moreover, the degree to which the average actual and normal times correspond varies considerably among the plants. At the bottom of Table 19 the average actual time is expressed as a percentage of the normal time. If the

[3] Fractions disregarded.

[4] One plant which did not report hours worked is not included.

average actual time corresponds with the normal time the percentage is 100, while the percentage will be greater or less than 100 as the average actual time exceeds or falls below the normal time of the plant. In 1925 the figures run from 87.1 per cent to 106.9 per cent, in 1926 from 89.3 per cent to 110.7 per cent, and in 1927 from 64.2 per cent to 123.1 per cent. Thus one finds marked differences among the plants in the degree to which the actual time corresponds with the normal time.

It will be noticed that even in those plants where the average actual time approximates the normal time, as in plants 52 and 63 in 1926 and plant 27 in 1927, there may

TABLE 19

DISTRIBUTION OF AVERAGE|| ACTUAL WORKING TIME IN CERTAIN STANDARD MACHINE-TOOL OCCUPATIONS† BY PLANTS‡

1925§

Average Hours Actually Worked per Pay Period	Plant Numbers											
	31	36	37	44	52	63	26	18	45	6	23	49
Under 40		2	1									
40 and under 41												
41 and under 42												
42 and under 43		1	2									
43 and under 44			2					1				
44 and under 45		1	4							1	1	
45 and under 46		6	3	1								1
46 and under 47	1	11*	10*	3*			2		3		1	1
47 and under 48	2	5	8	2			2		2	1	4	2
48 and under 49	*	1	2	6			9	1	7	1	*	1
49 and under 50		3		2			15*		6*	1	3	4
50 and under 51			1				15		14	*	1	2
51 and under 52	1	1	1				8	1	3	3		7*
52 and under 53							3			3		13
53 and under 54							6	1		1		2
54 and under 55								3*				
55 and under 56							1					
56 and under 57			1					1				
57 and under 58			1					2				
58 and under 59								2				
59 and under 60								1				
60 and over												
Total Men	4	31	36	14			61	13	35	11	10	33
Average Hours	48.0	46.2	46.8	47.7			50.4	54.5	49.4	50.6	47.9	51.0
% Actual is of Normal	109.1	96.3	97.6	99.4			98.9	106.9	95.1	97.4	87.1	92.8

|| Averages apply to 1925 and 1926, but not to April 1927.

† Drilling (Sensitive, Plain, and Radial), Turret Lathe and Screw Machine Operating, Milling and Lathe Operating in all periods; Planing and Boring in 1927 only.

‡ Plants Nos. 52 and 63 reported for 1926 only. Plant No. 54 did not report hours actually worked per man.

§ Includes only those men who worked a full year.

* Average actual time of plant.

TABLE 19—(*Continued*)

1926§

Average Hours Actually Worked per Pay Period	Plant Numbers											
	31	36	37	44	52	63	26	18	45	6	23	49
Under 40		1	2			5						
40 and under 41			1		1	3						
41 and under 42		2	3		1	2						
42 and under 43					4	2						
43 and under 44		6	3		4	3		4				
44 and under 45		7*	5*	4	8	3				1		
45 and under 46		14	6	4*	12	10	4	1				
46 and under 47	2	7	11	2	18	7*	4				2	1
47 and under 48	1		3	1	10*	4	18*		1	2		
48 and under 49	3*				14	5	7	1	3		3	1
49 and under 50					12	5	11		2	1	1*	
50 and under 51					9	1	1	1	3	1	2	2
51 and under 52	2				3	2		3*	7*	3*		1
52 and under 53					3	4		2	8	1	1	1
53 and under 54					1	1		2	3	1		4*
54 and under 55					1	2		2	1	2		13
55 and under 56					1	2		1		1		6
56 and under 57					1			1				2
57 and under 58								2				
58 and under 59						1		1				
59 and under 60												
60 and over					1							
Total Men	8	37	34	11	104	62	45	21	28	13	9	31
Average Hours	48.7	44.7	44 6	45 5	47 8	46 9	47.9	51.9	51.4	51.1	49.1	53.8
% Actual is of Normal	110 7	93.2	93.0	94 8	99.6	97 8	94.0	101.8	98.9	98.3	89.3	97.8

April 1927

Average Hours Actually Worked per Pay Period	Plant Numbers													
	31	20	529	815	3	14	25	36	37	44	53	63	227	773
Under 40		2				2		1	32*	7			1	10
40 and under 41		3												
41 and under 42														1
42 and under 43									1	1				
43 and under 44	2	3				4		1	4	2	1		2	5
44 and under 45	9*	6		1									1	1
45 and under 46		2	5*	10				2			1		1	1
46 and under 47				*		*				1*			1	3
47 and under 48		3*		1		3		*	1	7	2*		5*	17
48 and under 49		13			1*	27	64*	7	8	31	6	137*	18	59
49 and under 50		3						1						1
50 and under 51		1												8
51 and under 52										6				1*
52 and under 53														11
53 and under 54		1												5
54 and under 55				1									2	3
55 and under 56														4
56 and under 57														4
57 and under 58								1		1				8
58 and under 59														4
59 and under 60														8
60 and over		1												44
Total Men	11	38	5	13	1	36	64	13	46	56	10	137	31	198
Average Hours	44 0	47.1	45 8	46.1	48 5	40.9	48.0	47 1	30.8	46.5	47 3	48.0	47.6	52.9
% Actual is of Normal	100.0	104 7	101.8	102 5	101 1	97.8	100 0	98 1	64.2	96.9	98.6	100.0	99.1	110.2

TABLE 19—(*Continued*)

April 1927—(*Continued*)

Average Hours Actually Worked per Pay Period	Plant Numbers													
	5	323	646	674	710	717	54	765	8	26	208	6	32	347
Under 40	1	2*					1	1		5				1
40 and under 41					1									
41 and under 42					1			1						
42 and under 43	1													
43 and under 44														
44 and under 45										1				
45 and under 46	1									6	1			
46 and under 47										2				1
47 and under 48	*				1					2				
48 and under 49					1			1						
49 and under 50	7		1*	2*	0	2*				1*				
50 and under 51	1						30	15	1*	9				*
51 and under 52									1	42	2			
52 and under 53								*		2		13*	57*	4
53 and under 54					*		*							
54 and under 55							3	1		1				1
55 and under 56										2				1
56 and under 57								1			1			
57 and under 58														
58 and under 59							1	4		3				
59 and under 60					1									
60 and over					3		9	1			4*			
Total Men	11	2	4	2	17	2	44	25	2	76	8	13	57	8
Average Hours	47.3	35 0	49.5	49.5	53.2	49.5	53.3	52.0	50.9	49.5	63.3	52.5	52.0	50.5
% Actual is of Normal	96.5	71.4	101 0	101 0	108 5	101.0	106.7	104 1	89 8	97.1	124.2	101.0	100.0	97.1

Average Hours Actually Worked per Pay Period	Plant Numbers														
	570	46	55	211	400	475	604	4	23	35	49	56	57	209	477
Under 40		9	1					3	1	19	3		2		
40 and under 41		1		1						18					
41 and under 42										2					
42 and under 43										2					
43 and under 44			1							1					
44 and under 45		1	2		1				*	2	2				
45 and under 46		3						3	9	5	1	1			
46 and under 47										3					
47 and under 48								1		2					
48 and under 49		4			1			1	1	3					
49 and under 50			1	1				1	2	9					1
50 and under 51								1	1	31	3	1	*		3*
51 and under 52		3						*		3			2		
52 and under 53	2	6	1*		*					3*	1*				
53 and under 54		11*	3	3*	1			4		11	3				
54 and under 55			24	27	5	10*	1*	2		4	10	2*	1		
55 and under 56		2						26		19	29	29	1		1
56 and under 57	1	1								3					
57 and under 58		2								1			4		
58 and under 59		1						1		2			1		
59 and under 60	1									3		2			
60 and over	8*	11			1			2		62				1*	
Total Men	12	58	33	32	9	10	1	45	14	208	52	35	11	1	5
Average Hours	64.0	53 0	52.3	53.4	52.9	54.0	54.0	51.8	44.2	52.7	52.3	54.8	50.1	60 0	50.9
% Actual is of Normal	123 1	100 0	96 9	98.9	97.9	100 0	100.0	94.2	80.4	95.8	95.1	99 6	91.1	109 1	92.6

be a considerable proportion of the men whose actual working time is quite far from the normal time of the plant. Notice, for example, plant 63, where the average actual time is 97.8 per cent of the normal time in 1926 and 100 per cent in 1927. When the distribution of actual time is considered, it will be seen that every man worked the equivalent of the normal time of the plant in April 1927, but in 1926 only 5 out of 62 men worked an average actual time equal, on a yearly basis, to the normal time, even though the average actual time of the plant was 97.8 per cent of the normal time. This point is particularly important with regard to the personnel policies of individual plants. Significant weaknesses are often concealed by what appears to be a very satisfactory general situation.

No question is here raised as to where responsibility rests for the failure of some men to work the normal time of a plant. While this is an important question for purposes of control, the immediate point of interest is whether or not these data support the assumption that actual and normal time correspond. The answer is that they do not, although it does appear that a larger proportion of the men worked the normal time in a period of a week than in a period of a year.

In some cases the idea that actual and normal time correspond relates to weeks worked per year rather than hours worked per week. It is quite customary to take the earnings of a "representative" week and multiply by 50 or 52 weeks to estimate the yearly earnings of employees. When this is done, it is quite important to know how the number of weeks actually worked corresponds with the number assumed. In considering this point, only the data for 1925 and 1926 are pertinent, for they alone cover yearly periods.

Table 20 gives the percentage of full-year [5] employees by plants and by occupations. From this it appears that only

[5] A full year is here defined as 49 weeks or more in order to make allowance for vacations and sickness.

about 40 per cent of the men in either year worked a full year of 49 weeks or more in the plant from which they were reported. Consequently, if one were estimating yearly earnings from known weekly earnings, any conclusion reached would be applicable to less than 50 per cent of the workers.

The fact that about 60 per cent of the men worked only a part of a year is not as startling for some purposes as may appear at first glance. All the men with service records of less than one year are included in this figure and there is no way of knowing whether or not a part-year man in one plant really failed to work every week in the year at some plant. Only work histories of individual workers

TABLE 20

PERCENTAGE OF FULL-YEAR MEN BY PLANTS AND BY OCCUPATIONS

Plant Number	1925	1926	Occupation	1925	1926
6	78.6	100.0	Drill-press operating	48.7	30.2
18	44.8	44.7	Milling-machine operating	50.7	42.2
23	25.0	31.0	Turret-lathe operating	36.6	38.5
26	30.0	30.2	Screw-machine operating	35.4	34.2
31	44.4	72.7	Engine-lathe operating	51.0	47.6
36	24.8	34.6			
37	81.8	77.3	Total per cent	46.0	39.0
44	53.8	45.8			
45	71.4	58.3	Turret-lathe and screw-machine operating*	61.5	61.9
49	64.7	39.7	Special Group†	24.8	37.3
52		43.9			
54	51.6	47.1			
63		23.9			
Total per cent	42.9	39.3	Grand total per cent	42.9	39.3

* Includes only those men who could not be classified as either turret-lathe or screw-machine operators.

† Includes those men in one plant who worked on combinations of machines peculiar to that plant and who could not be classified under any one of the five occupations.

will give this information.[6] But if allowance is made for these part-year men, there were about 25 per cent in 1925 and 33 per cent in 1926 who had service records of one year and over but who failed to work a full year in the plant from which they were reported.

[6] "Earnings and Working Opportunity in the Upholstery Weavers' Trade," by Miss Anne Bezanson, is an excellent study of this kind.

As among plants, the experience in this regard varies considerably. At the one extreme are plants with either all or a large proportion of the men working a full year in both 1925 and 1926, while at the other extreme are plants where only 25 or 30 per cent of the men worked a full year. If both years are considered, there is only one out of 24 cases (11 plants in one year and 13 in the other) where all the men worked at least 49 weeks during the year.

On the basis of the data here considered, one seems justified in concluding that the actual working time does not correspond to the normal time to the degree commonly supposed. The variation between actual and normal time suggests the importance of obtaining factual information regarding actual working time in wage studies.

Influence of Variations from Normal Time on Earnings

Granted that only about 50 per cent of the men in April 1927 worked the normal time of their plants, what effect did this fact have on earnings? Here it may be well to confine attention to weekly earnings, since these are the earnings influenced most by the variation between actual and normal time.

One way of inquiring into the influence of non-normal time on earnings is to compare the average weekly figure for all the men with the figure for those men who really did work the normal time of their plants. From Table 21 it appears that for all the men, when the occupations are combined, the average is $35.55 as compared with $34.89 when only the normal-time workers are considered. Such a difference in weekly earnings is quite small and would seem to indicate that variations from normal time did not materially influence the average for the entire group.

When attention is turned to the individual occupations, much the same situation is found. In several instances there is almost no difference between the two figures. For ex-

[2] Fractional parts of an hour are not recognized.

ample, in engine-lathe operating the average weekly earning for all the men is $37.02 as against $37.09 for those who actually worked normal time. The largest differences occur in drill-press and planer operating, with averages of $32.28 and $30.36 for the former and $37.25 and $35.95 for the latter.

When the men in each group are separated not only on the basis of occupations but also on the basis of the normal time of their plants the same tendency to similarity in weekly earnings holds. From Table 22 it appears that, for men working in plants with normal time of "under 50 hours," the average weekly earning for all the men in the combined occupations is $34.04 and for only those who actually worked the normal time of their plants $33.90. For the period "50 hours and over" the figures are $36.92 and $36.03 respectively.

TABLE 21

AVERAGE ACTUAL WEEKLY EARNINGS IN SPECIFIED MACHINE-TOOL OCCUPATIONS FOR ALL OPERATIVES AND FOR THOSE WHO WORKED ONLY THE NORMAL TIME OF THEIR PLANTS

Occupation	All Operatives (Total Cases: 1456)	Normal Time Operatives (Total Cases: 760)
Drill-press operating	$32.28	$30.36
Milling-machine operating	34.93	34.49
Turret-lathe operating	35.52	36.23
Screw-machine operating	35.20	34.16
Engine-lathe operating	37.02	37.09
Planer operating	37.25	35.85
Boring-mill operating	37.68	39.12
Combined occupations	$35.55	$34.89

In short, if one assumes that the average weekly earning for those men who did work the normal time of their plants is substantially the same as it would have been had all men actually worked normal time, there is reason to infer that the variations from normal time did not exert much influence one way or the other on the average for all the men.

Such an inference would be supported by a comparison of total actual and total normal man-hours. From Table 23,

Section A, it may be seen that for the combined occupations the total actual and total normal man-hours are 73,261 and 73,996 respectively—a difference of only about 1 per cent. Much the same situation holds in Section B of the same table, where allowance is made for differences in normal working time. For example, in Section B-I the actual and normal man-hours are 33,280 and 33,181, and in Section B-II they are 39,980 and 40,815. This similarity between total actual and total normal man-hours may also be noticed in the individual occupations.

TABLE 22

AVERAGE WEEKLY EARNINGS IN SPECIFIED MACHINE-TOOL OCCUPATIONS FOR ALL OPERATIVES AND FOR THOSE WHO WORKED ONLY THE NORMAL TIME OF THEIR PLANTS WITH THE NORMAL TIME OF PLANTS SEPARATED INTO TWO PERIODS

Occupation	Normal Working Time			
	Under 50 Hours Per Week		50 Hours and Over Per Week	
	All Operatives	Normal Time Operatives	All Operatives	Normal Time Operatives
Drill-press operating	$32.95	$30.73	$30.93	$29.71
Milling-machine operating	33.59	33.03	37.56	36.81
Turret-lathe operating	33.76	38.81	36.26	35.20
Screw-machine operating	34.50	33.78	37.19	35.55
Engine-lathe operating	34.20	35.83	38.16	37.87
Planer operating	36.00	35.54	37.70	35.97
Boring-mill operating	38.14	39.82	37.58	38.70
Combined occupations	$34.04	$33.90	$36.92	$36.03

If one inferred from these comparisons that the influence of variations from normal time was negligible, even though the number of instances where men failed to work the normal time of their plants was rather numerous, a rather serious error would be committed. Not until the under- and over-normal time cases are separated from the normal time cases does the real importance of variations in working time manifest itself.

From Table 24 it may be seen that there is a distinct difference between the earnings of those who worked less and

those who worked more than normal time. This difference may be illustrated by the situation as found in engine-lathe operating. The average for the under-normal time cases, as given at the bottom of the table, is $32.19, as against $44.14 for the over-normal time cases. Furthermore, this difference is supported by the general level of earnings as shown by the frequency distribution of actual earnings.

Even though the variation above and below normal time results in distinct differences in weekly earnings, still the variations are such that their influence is cancelled so far as the average for all the men in an occupation is concerned, as is shown in the case of engine-lathe operating. Here the average for all the men is $37.01 as against $37.09 for the

TABLE 23

SUMMARY TABLE OF TOTAL ACTUAL AND TOTAL NORMAL MAN HOURS IN SPECIFIED MACHINE-TOOL OCCUPATIONS

Occupation	Section A		Section B–I		Section B–II	
	Total Actual Man Hours	Total Normal Man Hours	Total Actual Man Hours	Total Normal Man Hours	Total Actual Man Hours	Total Normal Man Hours
Drill-press operating	12,446	12,182	8,231	7,896	4,215	4,286
Milling-machine operating	10,385	10,238	6,748	6,517	3,637	3,721
Turret-lathe operating	6,230	6,428	1,578	1,769	4,652	4,659
Screw-machine operating	12,735	12,785	9,369	9,249	3,366	3,536
Engine-lathe operating	20,809	21,390	5,374	5,702	15,435	15,688
Planer operating	3,044	3,040	762	757	2,282	2,283
Boring-mill operating	7,612	7,933	1,219	1,291	6,393	6,642
Combined occupations	73,261	73,996	33,281	33,181	39,980	40,815

Section A includes all plants regardless of normal time.
Section B–I includes only plants with normal time of under 50 hours per week.
Section B–II includes only plants with normal time of 50 hours and over per week.

normal time cases, even though there are 137 men who worked short time as compared with 88 who worked overtime, their respective averages being $32.19 and $44.14.

One may well ask what reason there is to be concerned about the extremes when they cancel in such a manner that the average weekly earnings are approximately the same, both in the combined and in the individual occupations, for all the men as it is for those who actually worked the

TABLE 24

DISTRIBUTION OF ACTUAL WEEKLY EARNINGS IN NORMAL, UNDER, AND OVER NORMAL TIME BY SPECIFIED MACHINE-TOOL OCCUPATIONS

Weekly Earnings (in Dollars)	Drill-press Operating				Milling-machine Operating				Planer Operating				Turret-lathe Operating			
	Working Time			Total	Working Time			Total	Working Time			Total	Working Time			Total
	Under Normal	Normal	Over Normal		Under Normal	Normal	Over Normal		Under Normal	Normal	Over Normal		Under Normal	Normal	Over Normal	
Under 10																
10 and under 11																
11 and under 12	2			2					1			1				
12 and under 13	1			1		1		1					1			1
13 and under 14	1	2		3		1		1								
14 and under 15	2	1		3	1			1								
15 and under 16	1	2		3	2			2					1			1
16 and under 17	1		1	2	2			2								
17 and under 18	2	3		5									1			1
18 and under 19	1	1		2	1			1					1			1
19 and under 20					3		1	4	1			1	4			4
20 and under 21	3	2		5		1		1					2			2
21 and under 22	1	1	1	3	2			2					1	1		2
22 and under 23	1	3		4	2	3		5					2			2
23 and under 24	1	3	1	5	2	4		6					2			2
24 and under 25	1	12	2	15	1	3		4					1	3		4
25 and under 26	4	2		6		1	1	2								
26 and under 27	1	8		9	2	3	2	7	1	2		3	4	2		6
27 and under 28	3	7		10	3	2	1	6		2		2		3		3
28 and under 29	1	7	2	10	2	2	1	5					1	1		2
29 and under 30	3	8		11		2		2	1	1		2	1	1		2
30 and under 31	2	5	1	8	1	7	3	11	1	1	1	3	2	6		8

31 and under 32	1	9	3	13	1	4		5		2		2	2	1		3
32 and under 33	2	7	2	11	4	5		9		1		1	1	3	2	6
33 and under 34	1	10	2	13	3	23	2	28	1	4		5	3	5	1	9
34 and under 35	2	8	3	13	1	5	1	7	1			1		8		8
35 and under 36	2	6	2	10	1	9	5	15	2	6		8	2	5		7
36 and under 37		5	1	6	1	10		11	1	2	1	4		2	2	4
37 and under 38	2	6	2	10	1	4	3	8	3	2		5	5	3		8
38 and under 39		2	3	5		7	1	8	1	3		4	1	3		4
39 and under 40	2	3	5	10	2	6	2	10		1		1		1	2	3
40 and under 41	2	4	3	9		3	4	7		2		2		2	2	4
41 and under 42		1	4	5		1	1	2		2		2		3	2	5
42 and under 43			3	3			1	1	1	2		3		1		1
43 and under 44			1	1	3			3		1		1			2	2
44 and under 45	2		5	7			3	3						1		1
45 and under 46		2	2	4	1	3	1	5							2	2
46 and under 47			3	3	1		1	2						1	1	2
47 and under 48		1	1	2		1	1	2			1	1		1	1	2
48 and under 49		1	1	2		2	1	3		1		1		1	1	2
49 and under 50			1	1												
50 and under 51			5	5									1	1	1	3
51 and under 52			2	2	1		2	3			1	1				
52 and under 53			1	1			3	3							1	1
53 and under 54							1	1						1		1
54 and under 55									1			1		1		1
55 and under 56			2	2												
56 and under 57					1			1								
57 and under 58																
58 and under 59							1	1			1	1				
59 and under 60					1			1								
60 and over					1*	3†	1‡	5			2§	2		2**	3††	5
Total	48	132	65	245	47	118	44	207	16	35	7	58	39	63	23	125
Average Earning	27.08	30.36	40.04	32.29	31.28	34.49	40.09	34.93	33.77	35.8[illegible]	52.2[illegible]	37.2[illegible]	27.91	36.2[illegible]	46.47	35.52

*$66.50. †$64.50; $66.50; $68.50. ‡$70.50. §$68.50; $73.50. **$61.50; $63.50. ††$65.50; $67.50; $98.50.

TABLE 24—(*Continued*)

Weekly Earnings (in Dollars)	Screw-machine Operating				Engine-lathe Operating				Boring-mill Operating			
	Working Time			Total	Working Time			Total	Working Time			Total
	Under Normal	Normal	Over Normal		Under Normal	Normal	Over Normal		Under Normal	Normal	Over Normal	
Under 10					2			2				
10 and under 11												
11 and under 12												
12 and under 13												
13 and under 14	1			1	1			1				
14 and under 15												
15 and under 16									2			2
16 and under 17		2		2					1			1
17 and under 18	2			2	5			5	1			1
18 and under 19					4			4				
19 and under 20	1			1	3			3	3			3
20 and under 21		1		1	1	1		2	3			3
21 and under 22	2	1		3	4			4		1		1
22 and under 23		4		4	1			1	2			2
23 and under 24		2		2	2		1	3	2			2
24 and under 25	1	2	1	4	2			2	2			2
25 and under 26	1	4		5	1	3	1	5	4	1		5
26 and under 27	3	2	1	6	5	4		9	3			3
27 and under 28	2	3		5	6	3	1	10	3			3
28 and under 29	2	8	1	11	7	4	3	14				
29 and under 30	2	2		4	9	10	3	22	4	1		5
30 and under 31	2	8		10	8	8		16	2	1	1	4

31 and under 32	3	14		17	2	5		7	2			2
32 and under 33	3	13		16	10	10	2	22	1		1	2
33 and under 34	4	15		19	3	19	4	26	1	4	2	7
34 and under 35	4	15	1	18	10	9	3	22	3	3		6
35 and under 36	7	10	3	20	4	13	2	19	4	3		7
36 and under 37	3	22	1	26	10	14	5	29	3	4		7
37 and under 38	1	15	1	17	3	12	2	17	2	4	1	7
38 and under 39	5	9		14	5	10	3	18	3	9	2	14
39 and under 40		4	1	5	7	15	4	26	1	3		4
40 and under 41	2	2	1	5	1	7		8	1	6		7
41 and under 42	2	2	1	5	2	11	2	15		4	1	5
42 and under 43		4		4	2	3	1	6	1	5		6
43 and under 44	1		1	2	3	1	5	9	1	2	3	6
44 and under 45	1		2	3	3	3	5	11	1	1	1	3
45 and under 46	1		1	2	3	5	4	12	1		1	2
46 and under 47	3	2	2	7	1	3	1	5	1	2		3
47 and under 48		1	5	6	1	1	5	7			1	1
48 and under 49		1		1	1	2	5	8	1		2	3
49 and under 50	1		2	3	1	1	2	4			2	2
50 and under 51	1	1		2			2	2				
51 and under 52	1			1		1	2	3		1	4	5
52 and under 53	1	1		2	1		2	3	1		2	3
53 and under 54						2	1	3			2	2
54 and under 55						2		2		1		1
55 and under 56					2		2	4				
56 and under 57		1		1		3	4	7			1	1
57 and under 58	1			1			3	3				
58 and under 59							2	2			1	1
59 and under 60												
60 and over	1*	1†		2		2‡	5§	7	1**	1††	3‡‡	5
Total	65	170	25	260	137	187	88	412	61	57	31	149
Average Earning	33.70	34.16	40.96	35.20	32.19	37.09	44.14	37.02	31.41	39.12	47.85	37.68

* $95.50. † $62.50. ‡ $64.50; $67.50. § One at $60.50; one at $62.50; two at $63.50; one at $64.50; one at $72.50. ** $63.50. †† $63.50. ‡‡ $60.50; $62.50; $76.50.

normal time of their plants. In reply to this question several answers may be given. First, the purpose for which data are used may have a considerable influence on the relative importance of the points here considered. Second, if one had reason to believe that the ratio of under-normal to over-normal time cases was as evenly balanced in all periods as has been shown in this period, then there would be additional justification for disregarding the non-normal time cases under some circumstances and for some purposes. However, this cross-section picture of a single week does not appear to be representative of the situation during a longer run. It has already been shown that over a period of a year only about 9 per cent of the men worked the normal time of their plants, even when all the part-year men are excluded from the base figure. Third, even if the relation between the normal and the non-normal working time situation, as shown by this analysis, should hold for a considerable period of time, there is reason to believe that the situation here disclosed is of vital concern for many purposes. The general assumption that the actual working time of the employees corresponds with the working time of the plant is made very frequently even when the actual, not the general, accuracy of this assumption is of vital importance to the conclusion. It is quite possible that from the standpoint of stability in the market and from the standpoint of individual plant policies, a very unhealthy situation may be concealed by the "general situation" or by "conditions as a whole."

From the analysis of this and the preceding chapter, several conclusions may be noted. First, the term "normal working time," or any of its equivalents, requires more careful definition than it customarily receives. Second, when the term is used to denote full-time [7] operation, it is important to know whether or not the duration of the period is uniform. Third, when full-time operation is not uniform, this fact has an important bearing on hourly and weekly earnings. In this instance, hourly earnings showed a

[7] Referred to as "normal time" in this study.

marked tendency to vary inversely and weekly earnings showed a less pronounced tendency to vary directly with the duration of the standard time. Under such circumstances it is necessary to make a distinction between hourly and weekly earnings of labor, even though no problems of irregular employment are involved. Fourth, the assumption that actual and normal time correspond must be viewed critically. During a week in April 1927 a larger proportion of men worked the normal time of their plants than during either 1925 or 1926, still the non-normal time cases were too numerous and too widely distributed among plants in all three periods to be treated casually. Especially significant are the figures for 1925 and 1926, since only those men are considered who worked at least 49 weeks in the calendar year in the plant from which they were reported. Fifth, even though variations above and below normal time are numerous and considerable in degree, their influence may be so balanced as to leave the aggregate results as though there had been substantially no non-normal time.

CHAPTER VI

RELATION OF LENGTH OF SERVICE TO EARNINGS

Under modern methods of production, there is considerable interest in the question of how length of service is related to wages. Not only is there a difference of opinion regarding the importance of length of service in industry generally, but there is also a difference of opinion with regard to specific occupations in a given market. So marked were the differences of opinion among certain employers and so important did the issue seem that an experimental survey was undertaken to obtain factual information on the point.[1]

In the present chapter two aspects of this question will be considered. First, attention will be given to the factual situation with regard to length of service in the occupations being examined [2] and then to the relation which length of service bears to earnings—hourly, weekly, and yearly.

Factual Situation With Regard to Length of Service

Table 25 shows the percentage of the total number of employees in each of six periods of service. These data are given for both the individual plants and for all plants.

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[1] This was the principal reason for the survey of 1925 and 1926. Such a study is particularly interesting in the metal industry for several reasons. First, the workers are unorganized and hence not subject to any uniform regulations. Second, there is no general agreement among employers concerning the employment of workers. Third, there is no general requirement by plants that the operators of the machines being considered must have a formal apprenticeship training. Shop experience is frequently as acceptable, if not more so, than full apprenticeship. Fourth, the standard machine tools are likely to be used for a variety of work. Under these conditions it is conceivable that length of service might have a more important relation to earnings than where the conditions concerning training or the nature of the work are different.

[2] Planer and boring-mill operating were not included in the survey which furnished the data for this chapter.

TABLE 25

PERCENTAGE OF OPERATIVES OF FIVE MACHINE TOOLS IN SPECIFIED SERVICE GROUPS BY PLANTS

1925

Plant Number	Length of Service							
	Under 1 Yr.	1 Yr. and under 5 Yrs.	5 Yrs. and under 10 Yrs.	10 Yrs. and under 15 Yrs.	15 Yrs. and under 20 Yrs.	20 Yrs. and Over	Unknown	Total
6.....	7.1	28.6	14.3	21.4	14.3	14.3		100.0
18.....	31.1	24.1		27.6	6.9	10.3		100.0
23.....	70.0	17.5	5.0	2.5		5.0		100.0
26.....	60.6	37.4	1.0	1.0				100.0
31.....		66.7	22.2	1.1				100.0
36.....	62.4	25.6	7.2	1.6	1.6	.8	.8	100.0
37.....		11.4	31.8	50.0		4.5	2.3	100.0
44.....	42.3	26.9	23.1	7.7				100.0
45.....	6.1	38.8	22.5	12.2	12.2	8.2		100.0
49.....	31.4	25.5	27.5	9.8	3.9	1.9		100.0
52.....								
54.....	27.4	24.2	16.1	9.7	9.7	12.9		100.0
63.....								
All Plants	43.9	29.3	11.0	8.9	3.1	3.5	.3	100.0

1926

6.....		30.8	7.7	30.8	15.3	15.4		100.0
18.....	34.0	36.2		17.0	4.3	6.4	2.1	100.0
23.....	51.7	24.1	13.8	3.5		6.9		100.0
26.....	34.8	55.0	8.0	2.2				100.0
31.....		63.6	18.2	18.2				100.0
36.....	33.6	49.5	8.4	3.8	1.9	.9	1.9	100.0
37.....	2.3	9.1	18.2	61.4		4.5	4.5	100.0
44.....	37.5	29.2	25.0	8.3				100.0
45.....	10.4	22.9	33.4	14.6	8.3	8.3	2.1	100.0
49.....	44.9	26.9	19.2	5.1	1.3	2.6		100.0
52.....	19.4	35.9	35.4	4.2	3.0	2.1		100.0
54.....	23.6	21.6	23.5	13.7	9.8	7.8		100.0
63.....	73.7	26.3						100.0
All Plants	38.2	34.2	15.5	7.3	2.1	2.3	.4	100.0

From this table two features stand out rather prominently: first, the large proportion of men with relatively short service records in most of the plants, and, second, the presence of a nucleus of long service men in most plants.

Out of 652 men in 1925 and 1086 in 1926, about 72 per cent had service records of less than 5 years, while 38.2

TABLE 26

PERCENTAGE OF MEN IN SPECIFIED MACHINE-TOOL OCCUPATIONS CLASSIFIED BY LENGTH OF SERVICE

1925

Occupation	Length of Service							
	Under 1 Yr.	1 Yr. and under 5 Yrs.	5 Yrs. and under 10 Yrs.	10 Yrs. and under 15 Yrs.	15 Yrs. and under 20 Yrs.	20 Yrs. and Over	Unknown	Total
Drill-press operating*	35.5	23.7	18.4	15.8	4.0	2.6		100.0
Milling-machine operating	33.8	28.2	14.1	14.1	5.6	4.2		100.0
Turret-lathe and screw-machine operating	47.8	34.2	7.6	7.1	.6	2.1	.6	100.0
Engine-lathe operating	36.5	29.3	12.0	10.6	5.3	6.3		100.0
Total	39.9	30.1	11.7	10.6	3.5	4.1	.1	100.0
Special†	62.8	25.7	7.9	.9	.9	.9	.9	100.0
Grand total	43.9	29.3	11.0	8.9	3.1	3.5	.3	100.0

1926

Drill-press operating*	50.0	28.3	14.1	5.6	1.2	.8		100.0
Milling-machine operating	37.4	37.4	15.5	6.3	2.4	1.0		100.0
Turret-lathe and screw-machine operating	40.3	35.6	13.7	7.2	.7	1.4	1.1	100.0
Engine-lathe operating	27.3	30.6	20.3	10.7	4.4	5.9	.8	100.0
Total	38.6	32.8	16.0	7.5	2.2	2.4	.5	100.0
Special†	32.5	50.6	9.7	3.6	1.2	1.2	1.2	100.0
Grand total	38.1	34.2	15.5	7.3	2.1	2.3	.5	100.0

* All drilling.
† All men in Firm No. 36 who could not be classified under any one of the other occupations.

per cent in the former and 43.9 per cent in the latter year had service records of even less than one year. Thus it appears that a large proportion of men had not had extended service with the plants from which they were reported.

As among plants, there is considerable variation in this regard, although in most of the plants there is an appreciable proportion of short-service men. At the one extreme, in both years, is plant 23, with a large proportion of men with less than one year of service, and at the other is plant 37, nearly all of whose employees had over one year of service and about 90 per cent over five years. Between these ex-

tremes one finds most of the plants with fairly large numbers of short-service men. In 1925, at least 30 per cent of the men in every plant, except two, had not been in the employ of the plant a full year, and in 1926 there were 8 plants in which this was the situation for over 20 per cent of the men.

Even in the plants with a considerable proportion of short-service men, there are likely to be at least a few men with long service records. All the plants in 1925 had some men who had been in the employ of the same plant between 10 and 15 years, while all but 3 plants had some men who had been with them 20 years or more. Much the same situation is found in 1926.

When viewed from the standpoint of occupations rather than of plants, it does not appear that the longer-service men dominate any of the occupations. This fact is shown by Table 26.

The general conclusion seems warranted that for the occupations and for the plants considered, the men with relatively short service predominate, while a much smaller proportion of men form the stable portion of the working force.

The predominance of short-service men in these occupations is not as serious, from some points of view, as may at first appear. Within limits, there is an advantage in this condition of affairs to both workers and plants. In the absence of formal apprenticeship, even though a need for some training continues, and in the presence of a dynamic system of production, a worker may gain much in experience by moving from plant to plant. Moreover, he may lose very little, if any, in earnings by these changes. In fact, the adaptability which he acquires in this manner may enable him ultimately to command a higher price than he could command otherwise. One frequently encounters instances where a shop foreman encourages a worker to spend a year or two in other shops and then come back if he desires. In earlier days, movement from shop to shop was a characteris-

tic procedure for mechanics and the absence of experience in several shops was likely to be a distinct handicap. To some extent the pressure of volume production has modified this situation, but the influence of a deeply-rooted tradition is not quickly destroyed.

Furthermore, this mobility of workers may be the means whereby not only individual workers, but the workers as a group, may assume a stronger bargaining position. Certainly, with such mobility, there is little reason to suspect extensive ignorance on the workers' part of the conditions and opportunities in other plants, or even in other markets. A recent study in the textile industry presents in detail some of the advantages accruing to workers by moving from shop to shop.[3]

Not only to the workers but to the individual plants there may be some advantage in having men whose experience was acquired in several shops. Changes in technique, especially with a view to speeding production, are being made constantly. These changes originate within individual plants and constitute an internal economy to the plants in which they are first used. It is by means of the workers' carrying ideas from shop to shop that some of those internal economies of particular plants become the external economies of the market. Thus the fact that short-service men are a characteristic feature of the occupations here being considered may indicate a serious problem from some points of view, but certain possible offsetting advantages must be recognized.[4]

Relation of Length of Service to Earnings

In view of the large proportion of men with relatively short service records, can one infer that there is no monetary inducement to longer service? It is to the relation ex-

[3] Anne Bezanson, *Earnings and Working Opportunity in the Upholstery Weavers' Trade*, Philadelphia, 1928.

[4] There may be a grave doubt whether this undirected movement of workers is a satisfactory means of obtaining necessary economic adjustments.

isting between length of service and earnings that attention is now turned.

In this analysis it has seemed best to classify length of service into four periods. In so doing there is no implication of finality in the selection of these periods, although, after a minute analysis of the data,[5] the most marked tendencies relevant to earnings manifested themselves when the following periods were used:

Short service	Under 1 year
Moderately long service	1 year and under 5 years
Long service	5 years and under 10 years
Very long service	10 years and over.

The analysis which follows is based on Table 27, which gives average hourly, weekly and yearly earnings by occupations, plants and length of service for 1925 and 1926. Attention will be centered in the aggregate results by occupations, and for convenience these are plotted in Chart II. No comparisons will be made between plants. Data for individual plants are given in order that the tendencies to be considered may be seen to hold not only in general but quite widely among the plants.

There appears to be a direct relation between length of service and average hourly earnings. This tendency is evident without exception in milling-machine and engine-lathe operation for both years, while in the other occupations the average for the longest-service men is not the highest. In milling-machine operating for 1925 the tendency is shown in its most regular form. Here the averages for the short, moderately long, long, and very long service groups are 57.9, 65.4, 74.3, and 79.7 cents respectively.

[5] The data were originally classified as follows:

Under 1 week	2 years and under 3 years
1 week and under 1 month	3 years and under 4 years
1 month and under 3 months	4 years and under 5 years
3 months and under 6 months	5 years and under 10 years
6 months and under 1 year	10 years and under 15 years
1 year and under 2 years	15 years and under 20 years
	20 years and over

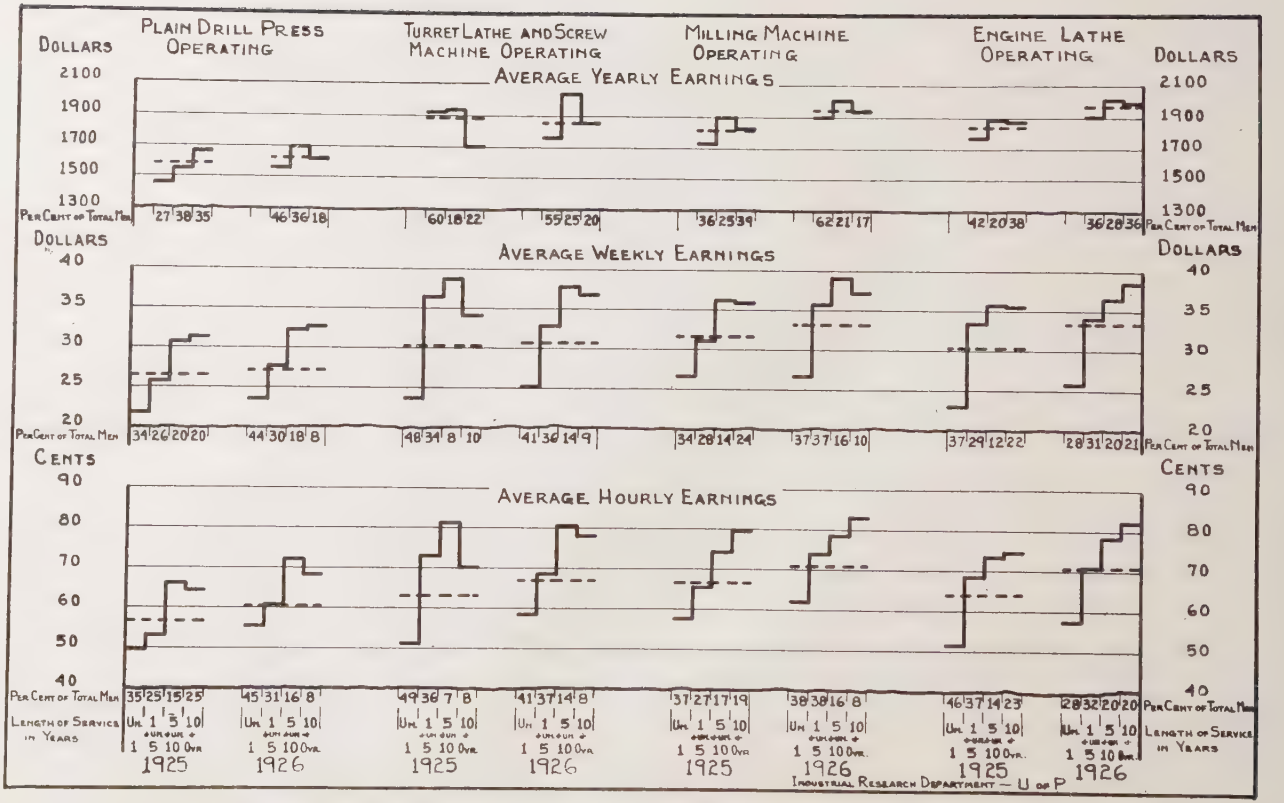

CHART II. AVERAGE EARNINGS FOR SPECIFIED MACHINE TOOL OCCUPATIONS BY LENGTH OF SERVICE

TABLE 27a

Average Hourly, Weekly and Yearly Earnings of Drill-Press Operators by Plants* and Length of Service for 1925 and 1926

Plant Number	Average Hourly Earnings†– Length of Service by Years								Average Weekly Earnings—Length of Service by Years								Average Yearly Earnings‡—Length of Service by Years					
	1925				1926				1925				1926				1925			1926		
	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	1 and under 5	5 and under 10	10 and Over	1 and under 5	5 and under 10	10 and Over
6				49.8				51.5				24.64				25.95			1289			1349
18																						
23	54.4	64.5		62.5	53.5	67.2	70.1	64.1	22.62	30.40		24.10	25.30	31.87	31.08	31.49	1571			1608		
26																						
31		53.9	79.1			55.6	76.2	81.4		25.16	38.95			27.24	35.87	37.56		1948		1658	1776	1840
36	29.1	28.3			28.5	38.4	39.5		12.65	11.63			11.22	16.52	17.01					1004	868	
37			72.4	73.3			75.5	74.1			28.50	36.23			28.10	33.55		1482	1869		1461	1798
44	57.6		62.8	72.8	52.4		64.5	67.0	25.80		29.90	34.61	19.18		28.81	30.81		1481	1765		1456	1540
45		52.7		67.0		56.3	53.8	68.2		26.37		33.45		29.62	26.52	33 35	1399		1740	1525		1734
49	45.6	47.3	58.2	56.7	48.0	46.4	63.1	65.0	22.29	26.42	30.51	29.75	20.05	25.06	35.07	35.41		1556	1499	1321	1789	1968
52					49.1	64.4	76.8	72.1	21.89				17.04	29.18	34.11	33.85				1661	1870	1253
54										25.42	28.24	26.58	20.37	20.04	29.24	26.11	1424	1470	1382	1315	1510	1358
63					60.3	63.9							27.33	28.57						1620		
All plants	49.7	53.4	66.3	64.5	55.2	60.5	72.1	68.6	21.84	25.76	30.51	31.32	23.74	27.73	32.19	32.35	1462	1566	1669	1562	1699	1617
Total number of men	19	13	8	13	79	54	29	15	24	18	14	14	84	57	35	16	9	13	12	28	22	11

* Firms Nos. 52 and 63 reported in 1926 only. Firm No. 36 had a number of men who could not be classified into these occupations; such men are not included herein.
† Firm No. 54 did not report hours actually worked, hence no average hourly figure for this firm.
‡ Only those men included who worked 49 pay periods (weeks) or more.

TABLE 27b

AVERAGE HOURLY, WEEKLY AND YEARLY EARNINGS OF MILLING-MACHINE OPERATORS BY PLANTS* AND LENGTH OF SERVICE FOR 1925 AND 1926

Plant Number	Average Hourly Earnings†—Length of Service by Years								Average Weekly Earnings—Length of Service by Years								Average Yearly Earnings‡—Length of Service by Years					
	1925				1926				1925				1926				1925			1926		
	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	1 and under 5	5 and under 10	10 and Over	1 and under 5	5 and under 10	10 and Over
6																						
18	47.5	37.1		61.2	56.7	44.9		64.5	27.51	20.06		35.22	25.58	22.33		35.30			1816	1135		1836
23	63.2	74.9			60.0	74.9			24.93	33.43			10.80	33.68			1638					
26	63.0	72.0		80.7		72.0		81.2	29.52	35.61		40.37		35.01		40.15	1847		2059	1858		2088
31																						
36					42.2								15.90									
37			105.4	102.2			101.1	103.7			49.53	49.56			44.55	47.93		2576	2673		2272	2595
44	80.2	69.0		75.4	66.1	63.5		69.0	35.40	32.51		37.67	19.89	27.87		30.73	1658			1373		
45			51.9	70.6			53.8	66.0			25.78	36.38			27.76	34.42		1324	1892		1416	1771
49	53.6	68.2	75.6	70.6	61.6	68.9	82.8	72.7	25.74	35.22	39.12	36.49	27.66	37.09	46.06	40.10	1796	1995	1861	1928	2306	2045
52					60.0	78.6	79.3	91.1					24.68	39.01	39.05	40.83				2167	2217	2037
54									28.57	27.77	28.90	28.98	26.63	28.22	30.82	28.96	1538		1496	1450	1603	1482
63					64.2	75.6							28.40	35.55						1839		
All plants	57.9	65.4	74.3	79.7	62.0	74.2	78.0	83.0	26.84	31.18	36.18	35.85	26.77	35.80	30.07	37.48	1735	1900	1831	1899	2077	1943
Total number of men	19	14	9	10	73	72	30	15	24	20	10	17	77	77	32	20	13	9	14	54	18	15

* Firms Nos. 52 and 63 reported in 1926 only. Firm No. 36 had a number of men who could not be classified into these occupations; such men are not included herein.
† Firm No. 54 did not report hours actually worked, hence no average hourly figure for this firm.
‡ Only those men included who worked 49 pay periods (weeks) or more.

TABLE 27c

Average Hourly, Weekly and Yearly Earnings of Turret-Lathe and Screw-Machine Operators by Plants* and Length of Service for 1925 and 1926

Plant Number	Average Hourly Earnings†—Length of Service by Years								Average Weekly Earnings—Length of Service by Years								Average Yearly Earnings‡—Length of Service by Years					
	1925				1926				1925				1926				1925			1926		
	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	1 and under 5	5 and under 10	10 and Over	1 and under 5	5 and under 10	10 and Over
6		75.5		38.0		75.5		48.2		38.67		19.45		38.00		25.02	1556		999	1962		1301
18	56.3	51.2		62.1	69.2	60.2		64.4	26.06	27.49		32.83	31.10	31.93		33.88	1680		1707	1773		1760
23			55.8	63.5			57.6	66.5			27.90	30.68			29.21	34.44		1451	1595		1461	1791
26	51.1	78.0	97.0	65.5	56.7	73.4	80.1	63.9	23.00	39.36	53.65	35.79	27.12	35.65	38.60	30.11	2085	2736	1861	1925	2143	1566
31		70.7		74.6		84.9		81.5		32.89		35.04		42.34		41.76	1624		1752	1882		2088
36	55.9	59.6		59.1	46.9	55.1		59.6	28.08	29.44		29.45	14.23	23.20		27.41	1874		1531	1355		1425
37			91.1	90.4	76.9		90.9	91.1			41.34	41.92	33.13		37.93	41.14		2041	2039		1850	2087
44		64.6	80.1			61.6	80.2			30.76	38.96			26.17	36.48		1539	1987		1578	1835	
45		58.1					58.5			29.34					29.72		1510				1697	
49	53.7	62.7	72.2	81.3		71.0	81.7	93.8	28.02	29.89	35.86	37.93		36.18	42.00	46.77	1525	1829	1934	1936	2127	2235
52					50.6	70.5	83.9	83.7					15.66	31.42	39.22	38.52				1928	2128	2011
54									27.54	33.34	33.93	33.43	36.35	35.25	32.70	33.21	1684	1764	1738	1750		1718
63					60.5	63.6							25.98	29.55						1535		
All plants	51.4	73.0	81.2	70.3	58.6	68.8	80.7	78.4	23.61	36.40	38.51	34.16	25.12	32.82	37.90	36.85	1925	1945	1707	1768	2045	1853
Total number of men	81	59	12	14	109	96	36	22	88	63	14	18	112	99	38	26	43	13	16	57	26	21

* Firms Nos. 52 and 63 reported in 1926 only. Firm No. 36 had a number of men who could not be classified into these occupations; such men are not included herein.
† Firm No. 54 did not report hours actually worked, hence no average hourly figure for this firm.
‡ Only those men included who worked 49 pay periods (weeks) or more.

TABLE 27d

Average Hourly, Weekly and Yearly Earnings of Engine-Lathe Operators by Plants* and Length of Service for 1925 and 1926

Plant Number	Average Hourly Earnings†—Length of Service by Years								Average Weekly Earnings—Length of Service by Years								Average Yearly Earnings‡—Length of Service by Years					
	1925				1926				1925				1926				1925			1926		
	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	Under 1	1 and under 5	5 and under 10	10 and Over	1 and under 5	5 and under 10	10 and Over	1 and under 5	5 and under 10	10 and Over
6	64.6	55.6	68.5	82.6		57.7	73.1	73.2	30.77	27.77	36.27	40.86		28.66	38.05	37.99	1444	1886	2118	1490	1979	1975
18	63.9	58.1		65.1	65.1	71.0		69.1	31.92	31.50		35.03	31.45	36.73		35.11			1812	1999		1839
23	69.0	75.2	76.9		64.2	75.4	76.0		28.28	35.36	38.19		30.78	36.38	37.48		1906	1986		1892	1949	
26	45.3	70.3	79.0		50.7	69.5	71.7	79.0	21.28	34.44	38.68		21.78	32.69	35.44	38.92	1829	1973		1913	1807	1946
31																						
36				76 5				78.6				35.87				35.71			1865			1857
37		90.4	91.4	90.8		92.8	96.9	92.9		43.00	43.15	41.30		43.13	44.22	40.41	2250	2387	2121	2317	2229	2067
44	52.5	71.2	80.7		50.2	68.3	79.7		17.71	33.97	37.47		24.43	31.74	35.26		1732	1911		1602	1763	
45	51.2	58.4	62.6	67.0	54.3	61.1	64.4	68.2	23.82	28.50	30.47	32.33	23.16	29.88	32.67	34.19	1473	1602	1711	1706	1746	1841
49	64.2	65.0	65.0	66.0	60.5	73.1	70.7	67.8	28.89	33.74	33.18	31.12	29.66	39.57	30.38	32 07	1721	1692		2002	2039	
52					60.3	75.9	83.3	101.4					21.16	33.99	38.33	48.19				1915	2133	2487
54											29.98	33.09			30.43	32.65		1559	1702			1714
63					66.0	72.1							30.81	36.33						1889		
All plants	51.8	68.9	73 9	74 7	57.9	71.2	78.5	82 2	23 03	33.69	35.82	35.67	25 87	34.08	36 56	38.57	1774	1882	1874	1907	2015	1998
Total number of men	76	61	24	38	74	83	53	51	76	61	25	46	74	83	55	57	45	21	40	46	36	47

* Firms Nos. 52 and 63 reported in 1926 only. Firm No. 36 had a number of men who could not be classified into these occupations; such men are not included herein.
†Firm No. 54 did not report hours actually worked, hence no average hourly figure for this firm.
‡ Only those men included who worked 49 pay periods (weeks) or more.

This tendency holds not only for each occupation in general but also quite widely for individual plants. That exceptions occur is in no way surprising, for even where long experience is usually desirable, it may be highly undesirable in particular instances.

If all plants had the same normal time and if the men actually worked a uniform number of hours per week, then differences in weekly earnings would be directly proportionate to those differences shown in hourly earnings. However, plants do not have the same normal time [6] and the degree to which actual time differs from normal time within a plant is not the same for all plants at a given time nor is it the same for given plants at different periods of time. In view of these differences, it is necessary to consider the relation of length of service to weekly earnings.

From Chart II, center section, it appears that the same tendency noticed in hourly earnings shows itself in weekly earnings. The tendency is without exception in plain drill-press operating in both years and in engine-lathe operating in 1926. In the other cases exceptions are again found in the longest service groups.

In this connection one may notice how variations in actual working time may influence average weekly earnings when such earnings are computed on the basis of yearly data. Average hourly earnings varied directly with length of service in both 1925 and 1926 for milling-machine operating, and the longest-service group had an appreciable advantage over the next longest-service group. However, on the basis of average weekly earnings this advantage of the former over the latter is removed in 1925, and in 1926 the longest-service group actually has a lower average than the immediately preceding service group. Another way in which variations in actual working time may influence weekly earnings is shown in drill-press operating. In both years the very long service group had an average hourly earning

[6] Most plants had a normal week of less than 50 hours.

below that of the immediately preceding group, the difference being more pronounced in 1926 than in 1925. But in both years the two service groups had substantially identical weekly earnings so that the advantage which the one group had over the other on the basis of hourly earnings ceased to exist on the basis of weekly earnings.

In considering average yearly earnings, attention is centered on a much smaller group in each occupation than in considering either hourly or weekly earnings. In the first place, a year is defined here as 49 weeks or more and this definition automatically excludes all short-service men. In the second place, those men who did not work 49 weeks or more in the calendar year, even though they had long service records, were excluded. When these allowances are made, only about 40 per cent of the men each year are available for the comparison of yearly earnings.

From the upper part of Chart II it appears that the average yearly earnings of long-service men are higher than those of men with moderately long service records. There is, however, only one case (drill-press operating in 1925) where the men with very long service records have an average in excess of that for the immediately preceding group. Thus it does not appear that there is, in general, any economic advantage in length of service when it is 10 years and over.

As a matter of fact, all the exceptions to the statement that wages vary directly with length of service are found in the group where the workers have the longest service records—10 years and over. The only occupations where this exception occurs on all three bases—hourly, weekly and yearly—and in both years, is turret-lathe and screw-machine operating. To what extent these exceptions are representative and to what extent they arise out of the meagreness of the data is not known at this time. It is very likely that, in the operation of the selected machine tools, and especially those just mentioned, there is some point beyond which efficiency is not increased and may decline by longer

service. Of course, even where this is true in general, there may be exceptions in individual cases, and although efficiency tends to decline, it may remain relatively high.

The question may be raised whether the short-service group may not consist principally of boys who are entering the trade or very young men, while more mature men are found in the other service groups. There is, of course, reason to suppose that in the long and very long service groups there would be more older men than in the short-service group. However, there is no indication that the short-service workers are in general immature. The lowest average age for short-service men in an occupation is 26.6 years for drill-press operating (1925) and the highest average age is 32.1

TABLE 28

AVERAGE AGES OF MACHINE TOOL OPERATORS BY LENGTH OF SERVICE AND BY OCCUPATIONS

Occupation	1925			1926		
	Under 1 Year	1 Year and under 5 Years	5 Years and Over	Under 1 Year	1 Year and under 5 Years	5 Years and Over
Drill-press operating	26.6	32.7	44.3	30.4	30.4	41.9
Milling-machine operating	32.1	28.8	42.9	30.8	30.5	37.5
Turret-lathe and screw-machine operating	31.6	32.9	39.2	29.0	30.7	38.2
Engine-lathe operating	28.2	29.6	44.2	31.1	30.2	41.3

for milling-machine operating (1925).[7] It would seem, therefore, that rather mature men constitute the short-service group of workers.

The conclusion to which this analysis seems to lead is that in the selected standard machine-tool occupations, manned by relatively mature men, wages tend to increase with length of service, subject to possible exceptions in the case of workers with service records of 10 years or more.

This conclusion has an unusually important bearing on

[7] Further analysis of the relation of age to earnings is given in "Factors Influencing the Collection of Wage Data," by H. LaRue Frain, Industrial Research Department, University of Pennsylvania.

some of the uses to which an average wage for an occupation is often put, as, for example, in connection with wage policies. If wages tend to vary directly with length of service, how useful is an average for all the men in an occupation when such an average is used to reflect prevailing wages?

In Chart II the broken horizontal line shows the average for all the men in that occupation and affords a ready comparison between that average and the average for each of the service groups. It will be noticed that the average hourly earnings for short-service men are considerably below, while the average for long and very long service men is considerably above, the average for each occupation as a whole. For the men with moderately long service records the average may equal, exceed or fall short of the average for the entire occupation. In no case does the average figure for the short-service men come within 5 cents of the average for the occupation, and usually the difference is between 9 cents and 12 cents. On the other hand, the average for long and very long service men exceeds the average for all the men in the occupation by amounts varying from about 8 to 18 cents.

The same situation holds for weekly earnings; the average for the occupation is considerably above the average for the short-service men, below that for the long and very long service group, and in no consistent relation to the average for the men with moderately long service records.

When the short-service men are excluded, as in yearly earnings, the average for the occupation is above the average for the moderately long service group in every instance except one and has no consistent relation to the average for any group. In short, for some purposes the average wage for these occupations has no significance. Such an average is consistently too high for the general run of new employees, too low for the workers with long and very long service records, and inconsistently related to the average for the moderately long service group.

There is another and somewhat surprising aspect of the conclusion that wages tend to vary directly with length of service. In the light of this tendency one might expect to find the bulk of the men in the long and very long service groups where wages are highest. But they are not. Out of a total of 652 men in 1925 and 1086 in 1926, roughly 40 per cent of the men each year had service records of less than one year and about 72 per cent had service records of less than 5 years. Thus the vast majority of the men were in the lowest-paid not the highest-paid service groups.

What may account for such a situation is unknown. There is, however, some reason to suspect that an unjustified reliance has been placed on the average for an occupation, whereas the purposes for which available data were used required that length of service be taken into account.

The fact that comparatively few men are in the service groups where wages are highest must not be interpreted as meaning that the men actually lose money by not remaining longer at a particular plant. They may, but they do not necessarily. It is quite conceivable that in moving workers may increase their wages even though their hourly and weekly earnings in the plant to which they go may be below the average of that plant. Not until it is possible to discover the gains and losses by inter-plant movement is it possible to interpret adequately the economic significance of the fact that, even though wages tend to vary with length of service, most of the workers here considered are not found in those service groups with the highest wages.

The analysis of this chapter leads to the conclusion that length of service is another factor having an important relation to wages. There are very few exceptions to the tendency for wages to vary directly with length of service except in the groups whose service records cover 10 years or more. Despite the general tendency, most of the workers are in the lowest- rather than highest-paid service groups.

CHAPTER VII

SUMMARY

Sometimes it may be more important to know the general location of a forest than it is to know the forest in detail, but at other times it is no less important to know something of the size and structure of the trees. In some cases there is much merit in observing wage phenomena in the large, but in other cases it is no less important to make detailed observations. It is with the latter type that this study is concerned. Aside from the immediate benefits of detailed analyses in disclosing certain features of wage phenomena and in furnishing working hypotheses, such analyses make it possible to check, in particular instances, broad generalizations. Moreover, when such studies are more numerous and extensive so that a body of inductive data is available, it may be possible to construct generalizations to be checked against those reached by deductive reasoning.

The principal objective of this study has been to examine the relation of certain variable factors to wages. Concerning these variables certain assumptions are frequently made and an examination of their validity in a particular instance has both theoretical and practical importance.

Not only the nature of the data but also the conditions accompanying their collection have been peculiarly favorable for such a study. The occupations selected are highly important in modern industry and are well understood by persons in the trade. Moreover, they are widely distributed throughout industry so that they are found under different circumstances. Workers are not subject to any collective regulations and employers are free to draw workers from any plant they see fit. The information on which the study is based has been furnished by employers, and much of it has

come from leading metal-manufacturing plants. That access was had to payrolls and other confidential information aided the study very materially.

The following are the more important conclusions to which the foregoing analyses lead.

1. Neither hourly nor weekly earnings are uniform in any occupation. Rather there appear to be wide variations in all of them. Even though the level of earnings, as measured by mean and median, is not the same in all occupations, there is marked similarity in the dispersion of earnings when measured by the relative standard deviation. Furthermore, the dispersion in the combined occupations is about the same as in the individual occupations. Whether or not the variations in earnings are greater than might arise from differences in ability alone is not known, but the variations appear to be sufficiently great to warrant examination. In view of the fact that these occupations are closely related, both in regard to mechanical features and the qualifications of the workers, and in view of the further fact that the degree of dispersion in earnings is much the same in the different occupations, there is some reason to believe that the forces contributing to differences in earnings are more or less applicable to all the occupations.

2. Among plants, wage levels, when measured by hourly earnings, are not uniform. Some plants tend to have relatively low and others relatively high wage levels, while between these extremes the wage levels of a large proportion of the plants are found. At and between 65 cents and 75 cents, or within a range of about 10 cents, the average plant earnings occur for a large proportion of all the plants.

3. Method of wage payment is a variable factor which appears to warrant attention in wage comparisons. Three general types of wage payment were used widely among plants and occupations. Both hourly and weekly earnings differ with the method of payment. Time earnings tend to be lowest and bonus earnings highest. Moreover, there is some tendency for piece and bonus earnings—both hourly

and weekly—to be 10 per cent and 20 per cent higher respectively than time earnings. The extent to which piece and bonus methods of payment are used and the differences in earnings under these methods, as compared with a time method, suggest that it is impossible in many cases and inappropriate in others to calculate earnings from rates and rates from earnings.

4. Working time is another factor which appears to require more consideration in wage analyses than it customarily receives. The expression "normal working time" often involves two fairly distinct ideas. One pertains to full-time operation and frequently carries the implication that this is uniform for all workers in an occupation within a market, and the other is that actual and full-time operation correspond.

So far as the first of these ideas is concerned, it is quite evident that all plants do not have a uniform period for full-time operation per week. There is, in fact, a difference of 11 hours per week in the normal working time of the plants in this market. Such a situation has an important relation to both hourly and weekly earnings. Hourly earnings tend to vary inversely and weekly earnings show a somewhat less pronounced tendency to vary directly with the duration of working time per week. Consequently, in wage comparisons where differences in normal time are involved, it becomes important to distinguish between hourly and weekly earnings even where there is no problem of irregular employment.

5. The assumption that actual and normal time correspond is not supported by these data. In a period of a week only about 50 per cent of the men worked the equivalent of the normal time of their plants, while in two periods of a year each only about 9 per cent of the men who worked a full year of 49 weeks or more had an average number of hours per week equivalent to the normal time of the plant. Moreover, both in 1925 and 1926, an appreciable proportion of the men who had service records of over a year worked less than a full year in the plants from which they

were reported, although nothing is known about other places where they may have worked in that year. The experience of individual plants is not the same either in regard to hours worked per week or weeks worked per year, although the tendencies here noticed are fairly general.

In the April 1927 data there appears to be an unusual balancing of overtime and short time so far as their influence on average weekly earnings is concerned. This is especially surprising since there is considerable variation in the normal time of the plants and since only about 50 per cent of the men actually worked the normal time of their plants. Aggregate results would have suggested a much closer correspondence between actual and normal time than really happened.

Finally, length of service appears to be a factor which has an important relation to wages and wage comparisons. Hourly, weekly and yearly earnings show a tendency to vary directly with length of service, subject to rather numerous exceptions in cases where the period of service is 10 years or more. Furthermore, this tendency is largely independent of the age of the employees. Despite the fact that the highest earnings are found among employees with service records of 5 years and over, the major portion of the employees have service records of less than 5 years and about 40 per cent of less than one year.

While a satisfactory explanation of this situation is not available, one may notice how unsatisfactory an average for all the men in an occupation is when such an average is used for purposes where length of service is an important factor.

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